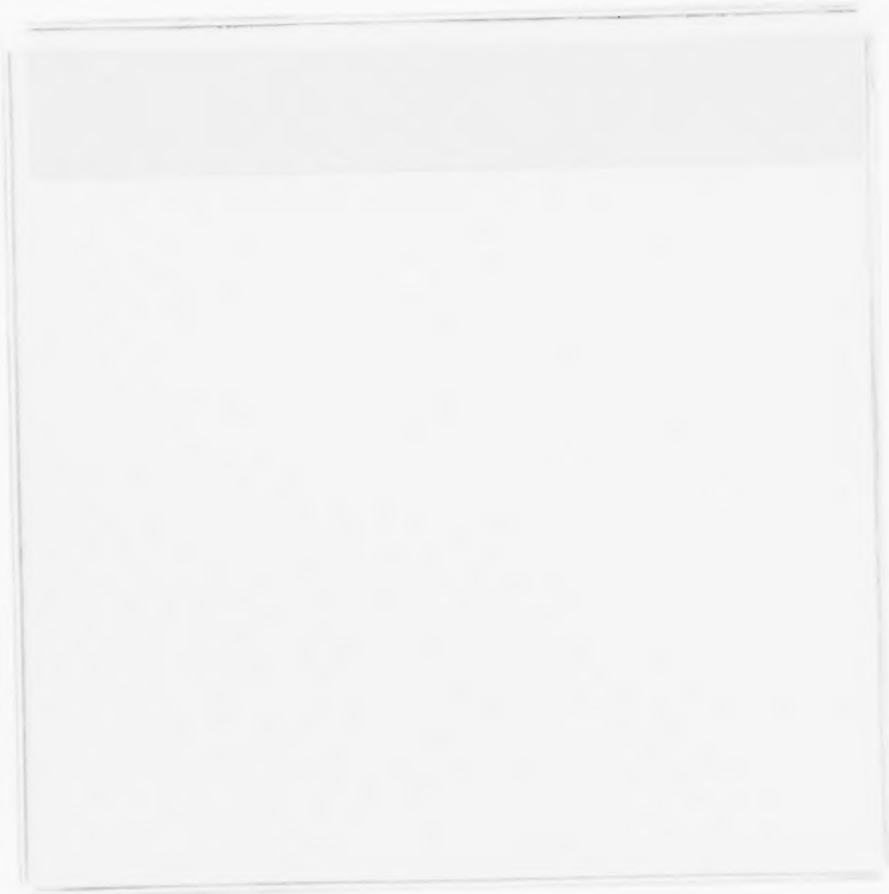
Moose Jaw River Watershed

Source Water Protection Plan

April 2006

Saskatchewan
Watershed
Authority

Moose Jaw River
Watershed Advisory
Committees



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1. Commitment from Participants

Dear Watershed Residents:

Karyn Mossing, Chair of the Joint Watershed Advisory Committee

An ancient proverb reminds us, "When you drink the water, remember the spring." In order to ensure safe drinking water for generations to come, Saskatchewan's high quality source waters and aquifers must be protected now and into the future.

In 2002, the Saskatchewan Watershed Authority began a partnership with local municipalities and interest groups to identify the threats and opportunities around source water protection in the Moose Jaw River Watershed, and to plan to address these threats. At that time, the local watershed association, representing the interests of residents, organizations and agencies within the Moose Jaw River Watershed, was revitalized. It was challenged with the role and responsibility of contributing to the development of a watershed management plan for the Moose Jaw River Watershed.

In 2003, an important planning process was started with the cooperation of that stewardship group and the Thunder Creek Watershed Advisory Committee. The result of that process is this document, containing a series of objectives, recommendations and key actions created to protect both surface and groundwater supplies. Key actions were designed to provide a clear direction as to what needs to be done, and by whom. The result of these actions will help to ensure clean water supplies for the future.

Many have joined our positive approach to incorporating Beneficial Management Practices in both the urban and rural landscapes of our communities in the Moose Jaw River Watershed. Our Association imagines the positive things we want to see – healthy families, parks and open spaces with abundant wildlife, clean drinking water, good jobs – and we believe we must work toward all of those things. We think it's important to stand back and reassess our management systems of our environment and the value systems that underlie them.

Every individual resident, organization and agency in Saskatchewan is and will be affected by the health of a watershed. In the Moose Jaw River Watershed, we are all responsible to take measures to identify and address issues affecting the watershed in which we live and work. By taking action now, we can experience significant economic and 'quality of life' returns when we invest in its future health.

In the coming years, you can be a part of the actions aimed at educating the public about environmental and watershed health issues as well as to undertake stewardship initiatives on private lands and enhancement work that will improve the water quality of creeks and streams. Landowners are encouraged to maintain, enhance and protect existing natural features and consider the ecological health of natural systems in their land use activities.

In March 2006, the Watershed Advisory Committee sought input and feedback on this plan through a series of open houses. That input was vital to ensure that this plan and its key actions adequately address your concerns around source water protection.

The development of this plan would not have been possible without the dedication, participation and hard work of the voluntary Watershed Advisory and Technical Committee members. Over the last three years, more than 120 different people have contributed to the development of the plan. Their dedication, enthusiasm and commitment are highly appreciated.

Sincerely,

Karyn Mossing
Chair of the Joint Moose Jaw River Watershed Advisory Committee

From your Planning Team

Dear Watershed Residents:

The Moose Jaw River Watershed Source Water Protection Plan was developed by the Watershed Advisory Committees and belongs to the watershed residents. The Planning Team would like to extend a sincere thank you to all members who volunteered and participated in the planning process. This plan is the result of many long hours of planning, and would not have been possible without the dedication and efforts of all members of the Watershed Advisory and Technical Committees.

This source water protection plan is not the end but rather the beginning of making a difference in protecting water supplies in the Moose Jaw River Watershed. The planning process has heightened awareness of many watershed residents around source water issues, but the work to implement this plan has just begun. And, implementation success will depend on everyone doing his or her part to protect source water.

The Saskatchewan Watershed Authority and other provincial organizations will be there to support the plan implementation. The success of this plan, however, will be up to you as a watershed resident to take up the challenge to do your part. Contact your local Watershed Advisory Committee member or your municipality to get involved in source water protection.

Sincerely,

Jennifer Nelson and John Durbin
Planning Team
Saskatchewan Watershed Authority

2. Introduction to the Moose Jaw River Watershed

The Moose Jaw River Watershed, as shown in Figure 1, is 9,360 km² in size. This area includes 22 rural municipalities, two towns, 10 villages and the City of Moose Jaw.

The upper headwaters of the Moose Jaw River are located approximately 30 km west of Weyburn in very flat terrain. The river flows northwest, paralleling the edge of the Missouri Coteau, with many small tributaries entering the river from the more rugged, higher terrain to the southwest. Near the town of Rouleau, the Moose Jaw River is joined by Avonlea Creek, a significant contributor of runoff because of the higher topography and more extensive drainage pattern within this basin. In the City of Moose Jaw, the Moose Jaw River is joined by Thunder Creek. Thunder Creek, with its headwaters southwest of Central Butte, flows southeast through Paysen and Kettlehut Lakes, and into Pelican Lake. Because of the relatively high elevation at the outlet of Pelican Lake, water usually does not spill out and continue on into Moose Jaw. Therefore, most of the water flowing from the Thunder Creek system into the Moose Jaw River is from Sandy Creek, whose headwaters are in the Missouri Coteau southwest of Mortlach. From the City of Moose Jaw the river flows northeast, joining the Qu'Appelle River approximately five kilometres downstream of Buffalo Pound Lake. The Moose Jaw River is the largest tributary to the Qu'Appelle River.

The **Watershed** covers all the land which could drain into the Moose Jaw River, including its tributaries.

Additional watershed information can be found in the Background Report, located in Appendix D on the CD attached to this document or at www.swa.ca.

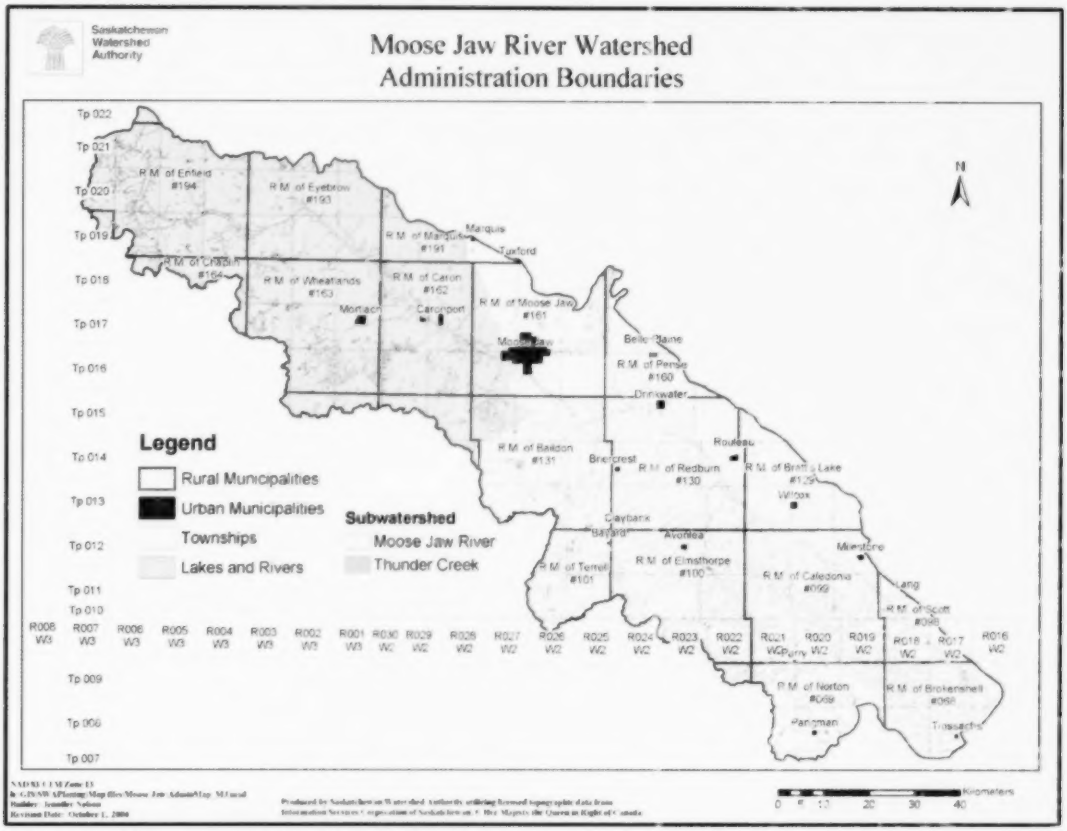

Figure 1: Moose Jaw River Watershed

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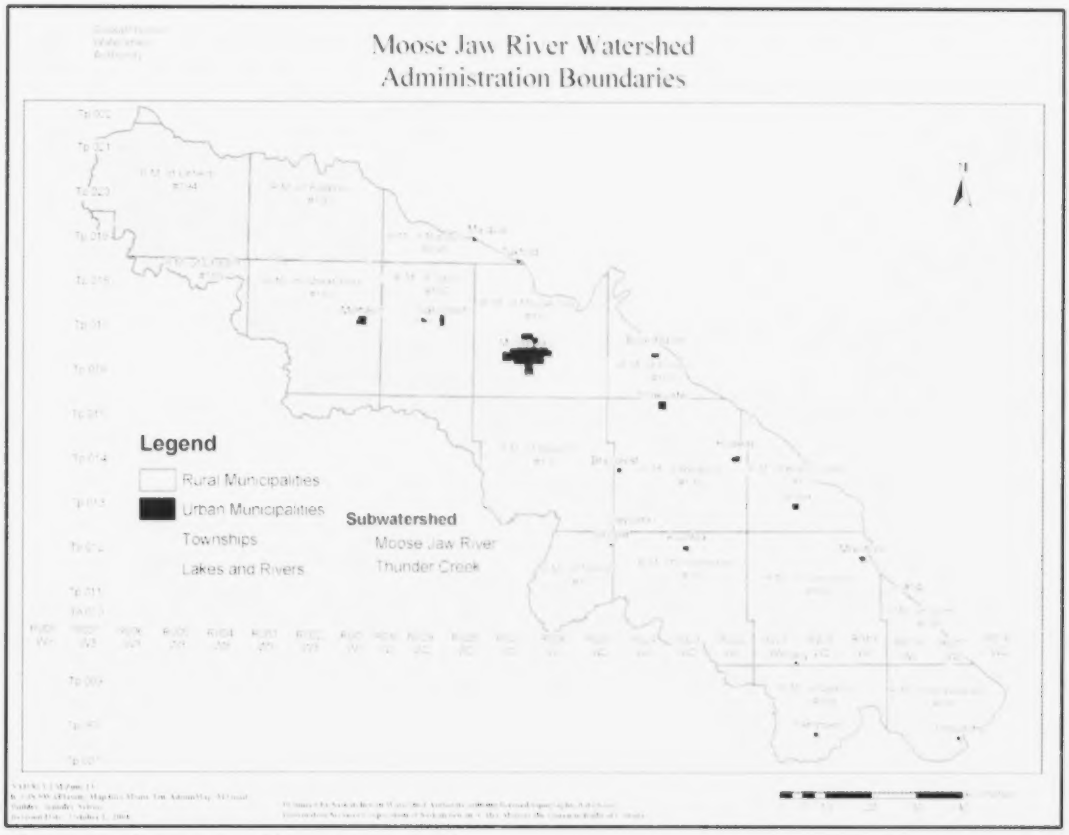


Figure 1: Moose Jaw River Watershed

3. Introduction to Source Water Protection

One Step in the Multi-barrier Approach to Drinking Water Protection

Drinking water supplies can be broken down into three parts: the source water, the drinking water treatment system, and the distribution system that carries the treated water to homes, businesses, schools, and other buildings. As water travels, it can become contaminated in many ways, some of which are known and others that can only be predicted. The "multi-barrier approach" to protecting drinking water supplies is a preventive approach that identifies all known and potential hazards and ensures barriers are in place to reduce or eliminate the risks of contamination. The implementation of this watershed-wide plan is the first step in protecting source waters.

It cannot be stressed enough that source water protection is only the first barrier to preventing water-borne disease or illness. The second barrier is the routine treatment of water sources. Treatment includes continuous disinfection of water through either chlorination or usage of ultraviolet light. The removal of turbidity causing particles, nitrite, nitrate, and trace metals such as arsenic and uranium, may also be required depending on their concentrations. **The only certain way to know what treatment is needed for a particular water supply is to have an expert conduct a comprehensive test of the source water, and then to implement the recommended measures to reduce all risks.**

For planning purposes, **Source Water** refers to all ground and surface waters, with an emphasis on drinking water.

Saskatchewan communities are required to meet strict standards for the testing and treatment of their water supplies. Private water supply systems, on the other hand, are tested at the discretion of the landowner. Although people are encouraged to test their water supply, most limit this to Saskatchewan Public Health's test for E. coli (bacteria) and nitrates. Based upon a survey in the Upper Last Mountain Lake watershed, 50 percent of farm residents do not have any type of treatment or filter unit on their water system.[1]

Most watershed residents have an interest in protecting source water and, as such, should be responsible for assisting in the implementation of this plan. Everyone should and can do their part. This can include large scale activities such as being a municipal councillor responsible for the drinking water for hundreds of people, or smaller scale activities such as practicing stewardship and testing and treating the water on your own farm.

[1] Saskatchewan Watershed Authority, *Summary of the Water Use Survey in the Upper Qu'Appelle Watershed*, April 2004.

Benefits of Protecting Source Water: Quality and Quantity

Quality – Where there are known sources of pollution, reducing these activities can prevent contaminants from reaching water supplies. Source water protection also includes maintaining and not overloading nature's own purification systems.

Protecting specific ecosystems such as wetlands, which purify drinking water by removing contaminants, also results in protecting water for recreational use as well as for livestock, wildlife, fish and their habitats. Natural riparian (shoreline) areas filter sediments which can carry chemicals and nutrients from upland runoff. This natural capacity to minimize the effects of runoff waters can be significantly reduced by a variety of human activities along the water's edge.

Source Water Protection is the prevention of pollution and the sound management of factors and activities that (may) threaten water quality and quantity of lakes, reservoirs, rivers, streams and groundwater.

There are economic benefits in having high-quality water available for use by many industries, including manufacturing and agricultural processing. Often the availability of dependable, high-quality water supplies can be the driver that induces an industry to locate in a particular area.

Higher quality source water will also require less complex treatment, which translates to less cost. And, should a failure occur in the treatment system, high quality source water poses a lower risk to human health.

Quantity - Water is a renewable resource and different forms of water are fully replenished during the hydrological cycle, but at very different rates. For example, water storage in lakes is replenished over a period of about 17 years, and in rivers over about 16 days.

Ground and surface waters are part of the hydrological cycle. Groundwater close to the surface can be influenced in both quality and quantity by surface activities. Deeper groundwater is influenced much less by surface activities and more by local geology. Surface water supplies are directly affected by surface activities and by seasonal and annual variations in the hydrological cycle. Significant droughts have occurred in the past and will occur in the future. Prudent water management in advance is the best way to minimize the impacts of drought. It is difficult to mitigate the impacts of drought once in the midst of one.

Protecting Municipal Surface Water Supplies

As previously mentioned, there are many benefits to protecting source waters, including the maintenance of safe and adequate water supplies. For communities dependant upon surface water, such as the Village of Avonlea, source water protection serves as the first barrier to prevent contaminants from reaching the tap.

An important step in protecting surface water supplies is to identify the areas of land from where the water drains. The drainage areas for communities which may be using surface waters in the Moose Jaw River Watershed are shown in Figure 2. It is assumed that concentrating source water protection efforts in these drainage areas will provide the greatest benefits for community water supplies.

Currently, the only community known to be using its surface water allocation is the Village of Avonlea. The water supply for the Village and surrounding area is the Avonlea Reservoir. The water allocations

Higher quality source water requires less complex treatment. This translates to less costly treatment and, should a failure occur, poses a lower risk to human health because contaminants may be in lower concentration.

shown in Figure 2 include those set aside for institutional use, tankloading and urban distribution. For more information on water allocations, effective drainage areas or procedures used to develop this map, please see Appendix F or contact the Saskatchewan Watershed Authority's Weyburn office at 306-848-2345.

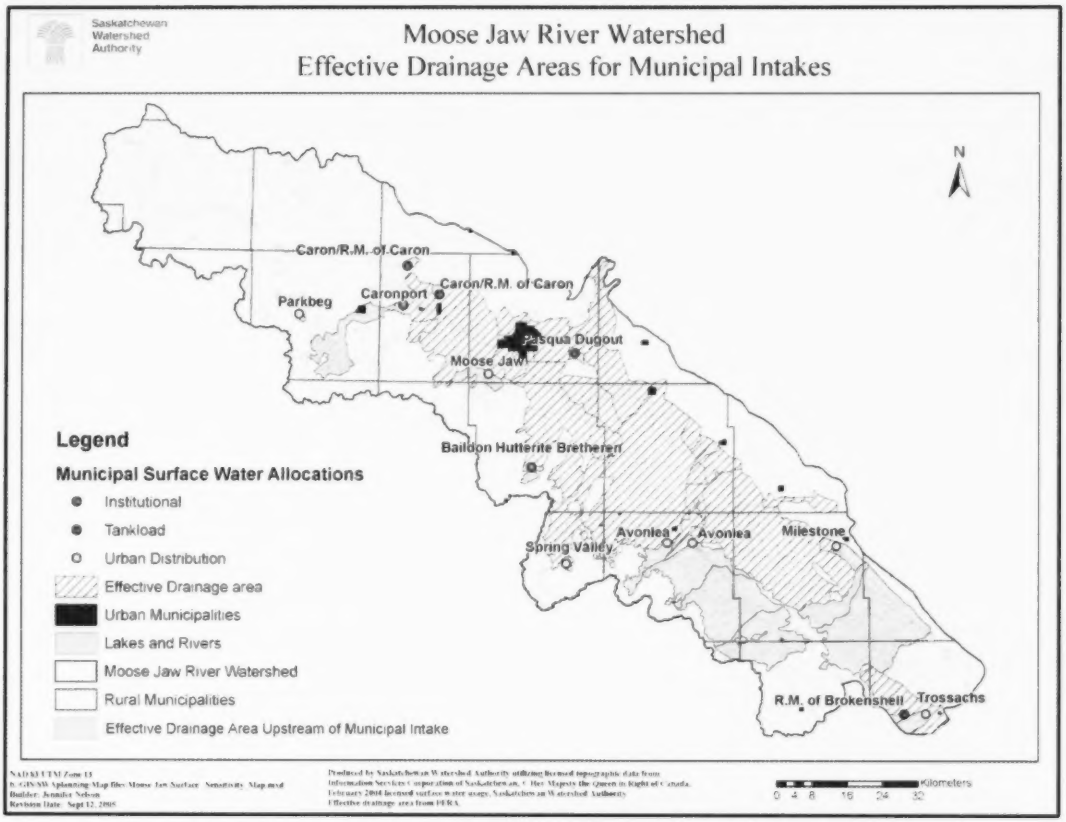


Figure 2: Effective Drainage Areas for Municipal Intakes

Municipal Well Assessments

There are two broad approaches to protecting municipal groundwater resources. The first is the aquifer protection approach, which involves mapping to determine areas vulnerable to groundwater contamination. Once the vulnerability maps are completed, land use guidelines and restrictions can be established in order to reduce the potential for contamination. The second is through municipal wellhead protection, which typically involves protecting only those portions of an aquifer contributing flow to a municipal well or wellfield. As a general concept, aquifer protection is a more conservative approach that focuses on protecting groundwater resources which are vulnerable to contamination, regardless of whether a municipal well has been completed in the aquifer. However, while this may be an ultimate goal in the watershed planning exercise, it will be difficult to implement at an early stage due to the large areas involved.

Both aquifer and wellhead approaches require costly and detailed technical work to develop a defensible protection plan. In reality, the research and expense of such plans may not be justified for many municipal wells and aquifers, as many aquifers are overlain by substantial thicknesses of glacial till or clay. These materials typically have a low permeability, which means that water and any contaminant movement through them can be very slow. This slow movement will allow natural processes to reduce the contaminant concentrations reaching an aquifer. Therefore, the thickness

and characteristics of till and clay above an aquifer determine the aquifer's vulnerability to contamination. In some cases, the natural protection offered by overlying clay and till effectively isolates an aquifer from contaminants on the land surface. In this case, land use practices may have little or no adverse impacts on groundwater resources.

Equally important is the fact that the well itself can provide a pathway for contamination into an aquifer. This can occur as a result of poor well construction, location or maintenance. Therefore, a full assessment of the risk to a municipal well is a two-part exercise involving an examination of the geologic conditions at the well and a site inspection to determine risks associated with well construction, location and maintenance.

A study of municipal wells, both for urban and rural municipalities within the Moose Jaw River Watershed, was conducted to determine the potential risks faced by each well or wellfield. This assessment was office-based and utilized information from files, databases and library reports. Using the thickness and assumed hydraulic characteristics of the geologic material overlying the aquifer being utilized, a vulnerability rating was assigned to each well or wellfield. This rating is based on geologic risk only and does not consider the integrity of the well. As such, the report represents only a preliminary scan of the risks to these wells. Before a full determination of the risk can be made, site inspections of each municipal well and interviews of staff responsible for operating those wells are required. Once this is done, both components can be used to determine the total risk facing each municipal well or wellfield.

The vulnerability ranking for the communities studied is shown in Table 1. This table indicates a number of municipal groundwater supplies in the Moose Jaw River Watershed are highly vulnerable to contamination. A full copy of the draft report can be found in Appendix G on the CD attached to this document.

High Vulnerability	**Medium Vulnerability**	**Low Vulnerability**
Briercrest	Milestone	Rouleau
Caronport/Caron	Lang	Wilcox
Mortlach	Parry well 3	
Spring Valley		
Pangman		
Parry wells 1 and 2		
R.M. of Caledonia 1/82		
R.M. of Baildon NW10-14-25W2		
R.M. of Baildon NE25-15-27W2		
Besant Campground		
Moose Jaw Wild Animal Park		

Table 1: *Draft* Wellfield Aquifer Vulnerability Index Ranking

This municipal well study only fulfilled the first part of the above assessment. Before priorities can be set for a wellhead protection plan, the second component must also be completed. All wells should be visually inspected and the staff responsible for the well interviewed. Those communities with a high vulnerability should consider developing an aquifer protection plan.

4. Watershed Planning Methodology

Consistent with Saskatchewan's *Safe Drinking Water Strategy*, the purpose of the Moose Jaw River Watershed Source Water Protection Plan is to identify the threats and opportunities around protecting source waters in the watershed and provide a plan to address these threats and opportunities.

To facilitate planning and local participation, the watershed was divided into the Moose Jaw River and Thunder Creek planning units. Representatives from local municipalities, conservation area authorities, irrigation associations, and recreational interest groups participated on these advisory committees. With critical support from the Moose Jaw River Watershed Technical Committee, these Watershed Advisory Committees guided the development of the Source Water Protection Plan. To help merge the ideas from both Committees into one plan, a Joint Moose Jaw River Watershed Advisory Committee was formed with representatives from each Watershed Advisory Committee and the Technical Committee. This planning initiative was also influential in revitalizing the Moose Jaw Creek Watershed Association #2. This organization, with an original objective to handle conservation and development issues, now has a technician on staff to work with watershed residents and communicate stewardship options. Participant lists for all committees can be found in Appendix A.

Joint Moose Jaw River Watershed Advisory Committee Meeting

In support of the planning process, a Background Report was developed to provide everyone with a collective understanding of the watershed. This report provides a wide range of information to help build awareness of the many factors which affect the watershed, and ultimately the water, in both quantity and quality. The watershed is described in terms of its physical characteristics, ecology, land use, climate, population demographics, and major economic activities including agriculture, tourism and recreation, and industry. Water resources are related in terms of quantity, quality, allocation and use. Current watershed management considerations include intensive livestock operations, sewage effluents, waste disposal grounds, storm water, well protection and decommissioning, industries, chemical use and storage, drainage, ice jams and flooding, climate change, and water conservation. Different land cover functions are described for upland, riparian and wetland habitats. Watershed management is explained by municipal planning and zoning, federal and provincial legislation, stewardship activities, and funding. The Background Report can be found in Appendix D on the CD attached to this document or at www.swa.ca.

The Moose Jaw River Watershed Source Water Protection Plan was formulated using a consensus-based approach. All objectives, recommendations and key actions were decided by consensus of the Watershed Advisory Committee members.

Specifically, this plan assembled pertinent information, analyzed threats and opportunities, built commitments to protect water, as well as summarized the committees' discussions and technical analysis in a number of recommendations. Finally, key actions were formulated as to what recommendations would be implemented, when and by whom.

Issues and Concerns

The following is a list of the issues and concerns which were addressed in the planning process. The objectives, recommendations and key actions formulated on each item can be found in section 6.

- Groundwater
  - Abandoned/Improperly Decommissioned Wells
  - Well Location and Wellhead Protection
- Surface Water Quality
  - General Surface Water Quality
  - Industry
  - Agriculture
    - Land Use and Cropping Management
    - Impacts in Riparian Areas (including cultivation and loss of buffer strips, livestock watering access and grazing management, cattle wintering sites, and rotational grazing)
    - Intensive Livestock Operations and Livestock Handling Facilities
    - Surface Water Drainage
  - Hazardous Material Storage and Disposal
  - Urban Impacts on Water Quality
    - Municipal Sewage Lagoons and Effluent Releases
    - Waste Disposal Grounds (landfills)
    - Urban Storm Water
  - Road Salts
- Surface Water Quantity (including floods, Pelican Lake, ice jams, and droughts)
  - Avonlea Reservoir's Water Supply to Downstream Users
  - Wastage and Inefficient Use of Water
  - Expanded Water Usage and Increased Water Storage Capacity
- Ecosystem Health
  - Noxious Weeds in Riparian Areas
  - Fish Habitat Degradation

5. Implementation Strategy and Monitoring Success

The following section lists a series of objectives, recommendations and key actions developed to address source water protection in the watershed. The key actions identify the specific organizations that have been asked to lead that particular action. While that organization may not actually complete the action, they are being asked to commit to ensuring it is completed. Partner organizations who are to assist in either a technical and/or a financial manner have also been listed. After the plan is finalized, each organization will be asked to formally commit to the appropriate key action(s). This process will allow for the incorporation and changes to the source water protection plan during public consultation.

Implementation Strategy

While each individual key action will be implemented by a specific organization, the coordination of these efforts is vital to the success of the plan. The Moose Jaw River Watershed Stewards Inc. (MJRWS) should be considered a proponent for this role. The Moose Jaw Creek Watershed Association #2 has applied for non-profit incorporation with charity status under the name of Moose Jaw River Watershed Stewards Inc.

The implementation of this strategy is dependant upon the following conditions:

The Watershed Advisory Committees will transfer the responsibility of coordinating the implementation phase to the Moose Jaw River Watershed Stewards Inc. provided that:

a. Moose Jaw River Watershed Stewards Inc. accepts the challenge.

b. The Saskatchewan Watershed Authority provides financial resources to the Moose Jaw River Watershed Stewards Inc. to cover administration/coordination costs associated with implementation (staff, events, education, and communications expenses).

c. Technical and science-based resources are readily available to the Moose Jaw River Watershed Stewards Inc. Science-based agencies will be invited to form the Moose Jaw River Watershed Stewards Inc. Technical sub-committee to provide technical assistance.

Objective 1:

Seek commitments to action from lead and supporting agencies.

Key Action: Transmit Source Water Protection Plan to each lead and supporting agency.

Completion date	Responsibility*
May/June 2006	**Joint Moose Jaw River Watershed Advisory Committee** Saskatchewan Watershed Authority

* The organization(s) responsible for leading each key action are in bold

Key Action: Seek a formal commitment to the key action items.

Completion date	Responsibility
May/June 2006	**Joint Moose Jaw River Watershed Advisory Committee** Saskatchewan Watershed Authority

Objective 2:

Develop subcommittees of three to four Moose Jaw River Watershed Stewards to oversee implementation.

Key Action: Develop a current and potential partnership list, expanding on current technical resources, watershed advisory committee members, local community groups, and others.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Hold a founding meeting for the Moose Jaw River Watershed Stewards.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Develop a general constitution and rules of order.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Develop a Funding Subcommittee to create a strategy and secure funding.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Develop a Source Water Protection Advisory Subcommittee to coordinate the implementation of the Source Water Protection Plan.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Develop a Technical Subcommittee to provide technical assistance.

Completion date	Responsibility
May/June 2006	**Moose Jaw River Watershed Stewards**

Key Action: Set a schedule for ongoing meetings.

Completion date	Responsibility
May/June 2006	Moose Jaw River Watershed Stewards

Objective 3:
Develop a detailed implementation plan with a budget and agency responsibilities.

Key Action: Confirm funding sources and amounts.

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Key Action: Develop and approve an annual budget.

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Key Action: Confirm agency participation.

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Objective 4:
Hire an implementation coordinator.

Key Action: Determine suitable office space and location.

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Key Action: Furnish office as required.

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Key Action: Hire staff member(s).

Completion date	Responsibility
July/August 2006	Source Water Protection Advisory Subcommittee (Moose Jaw River Watershed Stewards)

Key Action: Develop annual work plans.

Completion date	Responsibility
July/August 2006	**Source Water Protection Advisory Subcommittee** (Moose Jaw River Watershed Stewards)

Objective 5:

Develop a communication program to support implementation priorities.

Key Action: Develop a yearly communication plan.

Completion date	Responsibility
Sept/Oct 2006	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

Key Action: Release information on accomplishments and issues as required in press releases.

Completion date	Responsibility
Sept/Oct 2006	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

Key Action: Develop a newsletter and other public information materials.

Completion date	Responsibility
Sept/Oct 2006	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

Objective 6:

Issue yearly updates or progress reports that outline the activities and achievements on source water protection goals and objectives, and reiterate the necessary actions to ensure these are met.

Key Action: Hold a yearly press conference to release and circulate progress reports on accomplishments, issues and challenges.

Completion date	Responsibility
January 2007 - 2010	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

Objective 7:

Organize local meetings, workshops and public information sessions to ensure the public is aware of the goals and progress of the source water protection plan.

Key Action: Organize meetings as required to deal with local issues.

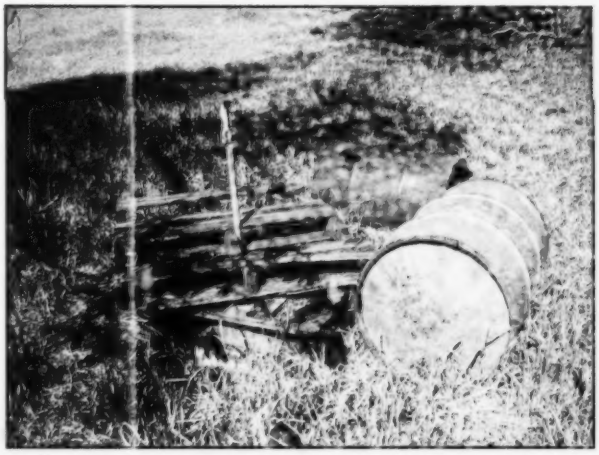
Completion date	Responsibility
As needed	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

Key Action: Investigate the opportunity to hold a yearly seminar, workshop, or conference.

Completion date	Responsibility
As needed	**Implementation Coordinator** (Moose Jaw River Watershed Stewards) Saskatchewan Watershed Authority

6. Planning Objectives, Recommendations and Key Actions

6.1 Groundwater



Objectives:

- Address the threat of groundwater contamination from abandoned and improperly decommissioned wells, and from existing wells which are poorly located, maintained or have inadequate wellhead protection.
- Increase awareness of the liability and risks of abandoned wells, and increase available funding for abandoned well decommissioning.

Abandoned/Improperly Decommissioned Wells

Groundwater is the source of water for many households in the watershed. It needs to be protected from contaminants moving through the soil or being dumped into unprotected wells. Natural biological processes in the subsoil are effective at reducing contamination. However, wells which are poorly protected, improperly decommissioned, or simply abandoned can provide direct conduits for surface water and chemicals to reach and contaminate groundwater aquifers.

The liability with regards to improperly decommissioned (or abandoned) wells which cause groundwater contamination rests with the landowner.

Well Location/Wellhead Protection

In order to have a protected groundwater system, the wells entering it must be properly located and maintained. For example, if a well is located near a domestic sewage disposal site, natural seepage may result in the contamination of the aquifer. Proper wellhead protection, including mounding clay around the wellhead and leaving the casing several feet above the ground, will help to protect the well. Proper maintenance, such as regular water quality testing and shock chlorination, should also be performed.

Recommendations

- Provide information on proper techniques and funding opportunities for decommissioning wells by producing an educational package, newspaper articles, and by having a well decommissioning field day(s).
- Educate owners of existing wells on proper wellhead protection practices, maintenance, shock chlorination, and routine water quality testing.
- Provide information to ensure that future wells are suitably located and installed with proper wellhead protection.
- Identify and locate abandoned and improperly decommissioned wells.

- The provincial government should maintain and enhance ongoing groundwater mapping activities.
- Saskatchewan Watershed Authority should complete the analysis required for the *Draft* Municipal Well Assessment Report. After that report is finalized, the communities identified as having a high vulnerability for municipal well contamination should consider developing an aquifer protection plan, with the financial and technical assistance of the Saskatchewan Watershed Authority.
- Develop a long-term monitoring plan for key aquifers to track natural fluctuations in water quantity and quality. If the plan takes longer than one year to develop, progress updates should be provided to the Moose Jaw Creek Watershed Association #2.
- Municipalities should consider land use zoning bylaws to provide protection of groundwater sources.
- The federal and provincial governments should provide total financial funding and technical assistance programs to decommission wells.
- Properly decommission unused Canadian National Railway/Canadian Pacific Railway wells.

Key Action: Deliver a well decommissioning field day each year.

Completion date	Responsibility
2005 and ongoing	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority

Measure of success: Completion of one field day per year for three years.

Key Action: Create a document addressing all issues surrounding groundwater protection.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Environment Saskatchewan Groundwater Association

Key Action: Enhance support for groundwater mapping activities.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority**

Key Action: Develop a long-term groundwater monitoring plan to track fluctuations in water quality and quantity.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration Saskatchewan Environment Saskatchewan Health

Key Action: Create an enhanced funding program for groundwater protection.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration

Key Action: Complete the analysis for the *Draft* Municipal Well Assessment Report.

Completion date	Responsibility
2007	**Saskatchewan Watershed Authority**

Key Action: Properly decommission unused Canadian National Railway/Canadian Pacific Railway wells.

Completion date	Responsibility
2010	**Canadian National Railway** **Canadian Pacific Railway**

6.2 Surface Water Quality

6.2.1 General Surface Water Quality

Overall Objectives:

- Long-term: Meet Saskatchewan's Surface Water Quality Objectives for the protection of fish and wildlife.
- Short-term: Achieve a measurable improvement in water quality and reduce erosion in areas most impacting water quality.

Water quality is an important consideration in the Moose Jaw River Watershed, especially for residents in and around the Village of Avonlea, who depend on Avonlea Reservoir for their drinking water. Water quality may also be a concern for downstream users, including those along the Upper Qu'Appelle downstream of the junction with the Moose Jaw River. Water quality contamination can also affect recreation, livestock, fish, wildlife, and soils under irrigation.

Most of the water quality data collected to date on the Moose Jaw River has been during wastewater effluent release periods. A monitoring program that includes spring flows and non-wastewater release periods is required to allow in-depth conclusions to be drawn from surface water quality data. Such a program would allow for the use of the Water Quality Index. This index is an effective means to summarize large amounts of data and provides a simple measure of overall water quality. The index compares values for various water quality parameters (i.e. nutrients, dissolved minerals, metals) to water quality objectives. The results of those comparisons are combined to provide a water quality ranking system (excellent, good, fair, poor) on a scale of 0 to 100.

There are many factors that can influence the water quality of the Moose Jaw River and its tributaries. Below are some of the general objectives and recommendations made regarding water quality. Specific objectives and recommendations to address specific concerns can be found in subsections 6.2.2 to 6.2.5.

Recommendations

- The provincial government should develop and fund a long-term surface water quality monitoring and analysis program to establish baseline data for Moose Jaw River and Thunder Creek at locations and sample frequencies that provide a high level of statistical confidence. The plan should also examine the feasibility of macro-invertebrate and sediment sampling, and the inclusion of the Ice Watch Program.
- The City of Moose Jaw should undertake more frequent sampling both during and outside of the effluent release periods.
- Encourage the continuation of Moose Jaw Asphalt's water quality sampling program.
- Provide aeration in reservoirs (e.g. Plaxton's Lake) if and where it has been determined that this could improve water quality.
- Ensure all culvert and bridge installations meet the minimum standards set out by the appropriate regulatory body to prevent erosion and washouts.

- Provide easily understood information to both rural and urban residents by using existing publications on:
  - watershed stewardship and the benefits of improved water quality;
  - individuals' roles and responsibilities as watershed stewards;
  - impacts from household products such as water softener salts, paints, detergents and other cleaners;
  - surface water quality standards, objectives and primary parameters; and
  - the respective responsibilities of Environment Canada, Fisheries and Oceans Canada and Saskatchewan Environment to regulate and control harmful substances.
- Municipalities should consider developing and reviewing existing land use zoning bylaws to provide protection for surface waters.

Key Action: Develop a water quality monitoring plan and provide funding.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration Saskatchewan Environment

Moose Jaw Creek Watershed Association #2 will write a letter requesting that the Moose Jaw Asphalt, Canadian Pacific Railway and other businesses share their data, and invite them to partner in monitoring efforts once funding has been secured from other sources.

Key Action: Provide information on stewardship, water quality, and agency responsibilities.

Completion date	Responsibility
2006	**Saskatchewan Network of Watershed Stewards** Fisheries and Oceans Canada Moose Jaw Creek Watershed Association #2 Saskatchewan Environment

This information should be posted online and be provided to the Moose Jaw Creek Watershed Association #2.

6.2.2 Industry

Objectives

- Ensure the public is kept informed about the status and efforts of Canadian Pacific Railway's and Moose Jaw Asphalt's remediation and monitoring plans.
- Build community confidence by developing watershed-wide, coordinated emergency preparedness plans which include source water protection.

Information on industries, mainly Canadian Pacific Railway and Moose Jaw Asphalt, were considered during the planning process. Concerns were raised about these industries due to their proximity to the Moose Jaw River.

Canadian Pacific Railway

Refuelling Station

One of the Watershed Advisory Committee's concerns is potential contamination from the refuelling station located adjacent to Thunder Creek. The City of Moose Jaw has the largest refuelling station in the Canadian Pacific Railway system and uses approximately 130 million litres of diesel fuel annually. In the past, fuel handling practices at Canadian Pacific Railway facilities have resulted in contamination of local environments with diesel fuel. In 1992 Canadian Pacific Railway, in accordance with Environment Canada's regulations, embarked on a program whereby all Canadian Pacific Railway facilities would receive an "in-depth" environmental investigation. In Moose Jaw, this investigation identified problems which were limited to the Canadian Pacific Railway site and resulted in a remediation plan being designed and implemented to control the in-soil spread of diesel fuel and to clean it up. Today, the problems attributed to past practices are no longer occurring, as Moose Jaw has now one of the most modern and environmentally safe railway fuel systems in North America.

Mercury

Mercury containment near the Moose Jaw Canadian Pacific Railway facility is also a concern. During the 1978 dredging of Plaxton's Lake, a significant amount of mercury was discovered in the sediments of the lake and Thunder Creek. The source of the mercury is unknown. The contamination could have been caused by any number of activities in the past when mercury products were improperly used, stored and disposed of. As a result, an agreement was reached between Saskatchewan Environment, Environment Canada, Canadian Pacific Railway, City of Moose Jaw, and the Qu'Appelle Valley Management Board for removal of the contaminated sediment and for its storage in bentonite clay-lined pockets adjacent to the creek. The provincial government assumed ownership and responsibility for these sites.

Thunder Creek within Moose Jaw
Photo courtesy of Fisheries and Oceans Canada

Monitoring of the mercury containment sites was conducted until the 1990's. At that time, there was no indication of mercury migration and mercury levels in the creek had significantly decreased, all of which indicated that the containment sites were meeting the objective of isolating the mercury from the creek. No further monitoring has taken place since the 1990's.

Proximity of rail line to Caronport's water supply

A possible train derailment and contamination of the Village of Caronport's water supply was raised as a concern. The Village utilizes a shallow groundwater infiltration system adjacent to Sandy Creek, which is within 30 metres of the Canadian Pacific Railway's train track. If a derailment and spill occurred, groundwater contamination could happen quickly.

Canadian Pacific Railway has comprehensive emergency response procedures in place to manage a derailment or spill. All train activity is controlled by Rail Traffic Controllers based out of the Network Management Center in Calgary. For emergencies, there is a dedicated phone line monitored 24 hours a day, seven days a week, 365 days a year (1-800-795-7851).

Canadian Pacific Railway also works with communities to ensure that municipal emergency staff know what to do in an emergency. Canadian Pacific Railway's "table-top exercise" allows a trained facilitator to work with fire, police, and other emergency response staff to run through different scenarios utilizing a community's emergency preparedness plan. This exercise is designed to help improve existing preparedness plans. Canadian Pacific Railway will also set up real-life mock disasters to evaluate a plan's effectiveness and worker response times.

Moose Jaw Asphalt

Moose Jaw Asphalt is located directly adjacent to the Moose Jaw River. This site was formerly a refinery that had been contaminated. To address environmental concerns, a local Environmental Advisory Committee is in place to provide advice on environmental issues. The committee meets four times per year.

Moose Jaw Asphalt has been actively involved in environmental improvements. Remediation measures have included the following projects: bioslurping, biosparging, east tank farm trench, golf course trench and river sheen (investigation), phytoremediation, poplar plot, and settling pond area. For further details on these efforts please refer to page 54 of the Background Report. A long-term monitoring program was established in 1988 and now includes eight monitoring sites on the Moose Jaw River.

Recommendations

- Request that Canadian Pacific Railway and Moose Jaw Asphalt continue to provide an annual report on their remediation efforts for review by the Moose Jaw Creek Watershed Association #2.
- Undertake a joint Canadian Pacific Railway (and Canadian National Railway) table-top emergency exercise with municipalities and communities in the watershed to help train municipal emergency staff on how to react to spills and other emergencies near water.

Key Action: Organize and conduct an emergency preparedness exercise.

Completion date	Responsibility
2006	**Emergency Measures Organization** All municipalities in the watershed Canadian National Railway Canadian Pacific Railway

6.2.3 Agriculture

Overall Objectives

- Minimize negative agricultural impacts in the watershed.
- Facilitate a change in the public's negative perception of agricultural impacts on water quality.

The dominant land use in the watershed is agriculture, with 70 percent of the agricultural land being used for annual crop production. As of 1992, approximately eighteen percent of the land was in grassland, the majority of which is located along the western portion of the watershed in the Missouri Coteau. Due to its dominant presence in the watershed, agriculture has a very visible influence on the landscape.

Photo courtesy of Saskatchewan Agriculture and Food

Ecological goods are the products of the processes and interaction of earth's natural systems, such as clean air and fresh water.

With such a dominant presence, agricultural producers directly influence natural ecosystems in the watershed. Management considerations for native prairie, riparian areas, and wetlands should be linked to the "ecological goods and services" that these natural ecosystems provide for society as a whole. Natural wetlands, for example, play a role in filtering harmful chemicals from water, recharging groundwater, and providing habitat for waterfowl when properly maintained. On grain land, however, there is the tendency to develop wetlands and other natural areas to maximize land use. An incentive program rewarding landowners for managing and conserving natural ecosystems could provide a means to prevent further loss of ecological goods and services.

Ecological services are the services provided by the processes and interaction of the natural world, such as groundwater recharge and purification of air and water.

The Environmental Farm Plan program is part of the federal government's Agricultural Policy Framework and allows individual producers to identify their operation's environmental risks. While addressing a wide variety of issues including water, soil, air and biodiversity, this process also covers many of the same issues included in this source water protection plan. Consequently, the Environmental Farm Plan program is endorsed by the Watershed Advisory Committees but is not mentioned in the other agricultural sections simply to avoid redundancy. The Moose Jaw Creek Watershed Association #2 is actively promoting the Environmental Farm Plan program and is currently pursuing the development of an Agri-Environmental Group Plan. This group plan will allow a number of producers in the watershed to collectively focus on one priority issue and the applicable beneficial management practices.

Recommendations

- Provincial government agencies, through collaboration, should identify hot spot areas which contribute to water quality deterioration and mitigate by using beneficial management practices.
- Educate the public on both the good and bad practices that can affect water quality.

- Encourage the press to report positive agricultural stories and not only "doom and gloom."
- The provincial and federal governments should provide funding for a watershed coordinator to work on promoting beneficial management practices in the Moose Jaw River Watershed.

Key Action: Identify agricultural impacts to water quality and mitigate with beneficial management practices.

Completion date	Responsibility
Ongoing	**Moose Jaw Creek Watershed Association #2** **Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration Saskatchewan Environment Saskatchewan Watershed Authority

Key Action: Provide public education on agricultural impacts to water quality by using existing publications and writing news articles.

Completion date	Responsibility
Ongoing	**Moose Jaw Creek Watershed Association #2** **Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration

Measure of Success: One article produced per year.

Key Action: Promote Environmental Farm Plan workshops.

Completion date	Responsibility
Ongoing	**Provincial Council of Agriculture Development and Diversification Boards Inc.** Moose Jaw Creek Watershed Association #2

Key Action: Provide funding for a watershed coordinator to promote beneficial management practices.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2

Key Action: Deliver the Agri-Environmental Group Plan.

Completion date	Responsibility
2008	**Moose Jaw Creek Watershed Association #2.**

Measure of Success: Complete 150 projects by 2008.

6.2.3.1 Land Use and Cropping Management

Objectives

- See overall objectives for agriculture.

Annual cropping practices, such as tillage and the use of fertilizers and pesticides, may have an impact on water quality. The Technical Committee provided information from the Prairie Farm Rehabilitation Administration literature review "A Prairie-Wide Perspective of Nonpoint Agricultural Effects on Water Quality, 1997" (Harker et al., 1997).[2] This study concluded that it is uncertain what impacts occur from agriculture in the prairies, but that impacts could occur in "hot spot" areas. Unfortunately, there is a lack of water quality information to target specific problem areas in the Moose Jaw River Watershed.

Sediments can cause water quality problems and act to transport other contaminants, such as fertilizers and pesticides. Although natural stream bank erosion is a major source of sediments, erosion from fields with high tillage disturbance and poor vegetative cover can also be a significant contributor. The type and amount of vegetative cover have the greatest role in controlling erosion. Vegetation will slow runoff and act to filter and trap sediments along with any contaminants being transported.

Cropland adjacent to the Moose Jaw River
Photo courtesy of Fisheries and Oceans Canada

Analysis

The Technical Committee produced a report entitled "Sedimentation and Erosion: Where is erosion occurring?" This report contains details concerning erosion, causes, and recommendations. It also contains a map which highlights possible hot spots or sources of erosion. This report can be found in Appendix E on the CD attached to this document.

Recommendations

- Model or monitor nutrient loading to determine how much influence agricultural practices are having on the watershed.
- The provincial and federal governments should encourage the conversion of lands to permanent pasture cover by:
  - increasing (incentive) payments to producers, so change is financially viable and is ecologically sustainable;
  - modifying screening criteria to include higher-assessed lands for funding eligibility in order to encourage producers to use more sustainable and economical land use practices;
  - finding economical solutions and incentives for landcover conversion in riparian areas; and
  - coordinating funding and program delivery to streamline available funding for cropland conversion to allow producers to access funding from multiple agencies.
- Promote, demonstrate and encourage the use of beneficial management practices which reduce negative agricultural impacts, such as conservation farming (minimum tillage, buffer strips, etc.), shelterbelts, grassed/treed riparian areas, and the grassing of erosion channels/water runs.

[2] Prairie Farm Rehabilitation Administration, Prairie Resource Division, report. Agriculture and Agri-Food Canada, 1800 Hamilton Street, Regina, Saskatchewan, Canada S4P 4L2 or e-mail: pf10273@em.agr.ca.

Key Action: For new programs, increase funding payments for land conversion to permanent cover and coordinate program delivery among multiple agencies.

Completion date	Responsibility
2008	**Prairie Farm Rehabilitation Administration** Ducks Unlimited Canada Nature Saskatchewan Saskatchewan Environment Saskatchewan Watershed Authority Saskatchewan Wildlife Federation

Key Action: Explore a yearly payment program for ecological goods and services covered by conserved lands.

Completion date	Responsibility
2008	**Prairie Farm Rehabilitation Administration**

Key Action: Conduct a research study to determine agricultural impacts on nutrient loading and water quality.

Completion date	Responsibility
2010	**Saskatchewan Watershed Authority** Joint Moose Jaw River Watershed Advisory Committee Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Environment

The Joint Moose Jaw River Watershed Advisory Committee and the Moose Jaw Creek Watershed Association #2 will write letters to request participation in Saskatchewan Watershed Authority's proposal to assess agricultural impacts on water quality.

6.2.3.2 Impacts in Riparian Areas

Objectives

- Maintain, establish and enhance buffer strips and bank stabilization to reduce erosion where impacts on water quality occur and mitigation is cost effective.
- Prevent nutrients and other contaminants from agricultural operations and related processing and handling facilities from reaching the Moose Jaw River and its tributaries.

Cultivation and Loss of Buffer Strips

Riparian (shoreline) areas serve many important functions in the watershed. When functioning properly, riparian areas produce a diverse and abundant vegetative cover that traps sediment, filters pesticide and fertilizer residues, prevents erosion, slows wave action, and recharges the groundwater. They also provide fish habitat both directly, through shade and cover, and indirectly by providing a food source such as insects. Riparian vegetation is water tolerant and usually consists of thick dense brush, trees, and grasses, the roots of which bind the soil together and help to stabilize the banks.

Healthy riparian area

Riparian areas serve many important functions in the watershed. When functioning properly, the abundant vegetation traps sediment, filters pesticide and fertilizer residues, reduces erosion, slows wave action, and recharges the groundwater.

Streambank vegetation will slow water flows and result in less erosion, keep water cool, and help to maintain natural channel shape (i.e. narrow and deep vs. wide and shallow). A healthy riparian area is critical for improving water quality and reducing erosion.

Riparian areas also provide productive and sustainable grazing areas if they are properly managed using rotational grazing.

Because the flood plain has very fertile soils, much of the riparian vegetation along the Moose Jaw River has been removed for cultivation purposes, and is therefore taxed as productive land. If these areas were restored, they would be taxed at a lesser rate as conserved or non-arable land, and could still be used for other purposes such as grazing or haying.

Livestock Watering Access and Grazing Management

There are many good reasons not to allow livestock uncontrolled access to the river banks, the water's edge or to the open water. First, animal wastes can introduce disease-causing bacteria and pathogens into the water. Manure can also introduce additional nutrients, which in turn may contribute to algal blooms and oxygen depletion which are harmful to fish. Second, excessive grazing can limit the natural ability of the riparian (shoreline) zone to filter out surface runoff contaminates, and contribute to streambank erosion. And third, uncontrolled livestock can affect fish habitat in the stream through trampling of the bed and banks and through increased sedimentation.

Cattle Wintering Sites

Wintering, watering and feeding livestock on or adjacent to the Moose Jaw River and its tributaries can cause a number of problems. The risk of livestock mortalities due to drowning or exposure increases. As for impacting water quality, manure enters the stream after having been deposited

directly on the ice or washed in with the quick spring runoff. Also, because riparian vegetation has been trampled by hooves, uprooted while in a dormant state or browsed, there is little or no natural filtering capacity to prevent sediments and contaminants from being washed into the water.

Rotational Grazing

Using a grazing management plan which balances forage supply with livestock stocking rates and includes pasture rest periods will help eliminate erosion and increase the natural filtering capacity of all landscape vegetation. A grazing management plan will also help to control the spread of noxious weeds.

Recommendations

- The federal and provincial governments should develop programs to compensate or reward farmers for using any beneficial management practices that will protect water. Programs should include compensation for those who are already using these practices.
- Educate both rural and urban residents on the benefits of protecting and not cultivating riparian areas, and the need for buffer strips adjacent to rivers/gullies/creeks by using demonstration projects and tours of beneficial management practices sites (e.g. field squaring) and through the promotion and use of the Environmental Farm Plan program.
- Reduce the impact of livestock wintering sites in riparian areas by working in cooperation with local producers, promoting funding and technical assistance programs, developing demonstration sites and undertaking tours of farms using beneficial management practices.
- Recommend the use of rangeland beneficial management practices such as off-site watering systems, limited access ramps, rotational grazing, and recommended stocking rates.
- Conduct a riparian assessment to address vulnerable and high-risk areas.
- Plant and retain trees and other vegetation in riparian areas and areas of high winds.
- Promote the use of geo-textile products and bioengineering techniques to protect slopes and banks by assisting in establishing vegetation.

Key Action: Provide education on relocating or modifying wintering sites in riparian areas.

Completion date	Responsibility
Ongoing	**Saskatchewan Watershed Authority** *Moose Jaw Creek Watershed Association #2* *Saskatchewan Agriculture and Food*

Measure of Success: One demonstration project/tour per year, dependant upon riparian assessments.

Key Action: Educate on and demonstrate the benefits of protecting riparian and other sensitive areas.

Completion date	Responsibility
2006 and ongoing	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Watershed Authority

Measure of Success: One demonstration project/tour and one workshop per year until 2008.

Key Action: Conduct an assessment of riparian areas to address vulnerable and high risk areas.

Completion date	Responsibility
2008	**Moose Jaw Creek Watershed Association #2** Fisheries and Oceans Canada Saskatchewan Watershed Authority

6.2.3.3 Intensive Livestock Operations and Livestock Handling Facilities

Objectives

- Prevent nutrients and other contaminants from intensive livestock operations and related processing and handling facilities from reaching the Moose Jaw River and its tributaries.

Intensive livestock operations are defined under *The Agriculture Operations Act* as the confining of prescribed animals where the space per animal unit is less than 370 square metres. An animal unit is a means of comparing different species by manure output and is defined in the regulations of *The Agriculture Operations Act*.

An approval from Saskatchewan Agriculture and Food is required for any intensive livestock operation which: (1) uses an earthen manure storage; (2) involves the rearing, confining or feeding of 300 or more animal units for more than10 days in any 30 day period; or (3) confines more than 20 animal units (but less than 300 animal units) for more than 10 days out of 30 and is within 300 metres of any surface water or 30 metres of a domestic water well not controlled by the operator.

Photo courtesy of Ducks Unlimited Canada

For new intensive livestock operations, the operator is required to submit plans for waste storage and for waste management. Approval is issued if these plans demonstrate adequate protection for surface and groundwater resources. The project proposals are reviewed by various other government and non-government agencies to ensure compliance with all relevant regulations and to capture expert opinions in the area of water protection. Concerns have been raised about the existing, non-compliant livestock operations which were established prior to the regulatory approval process (1971). For example, all of the livestock operations located within the City of Moose Jaw do not

require approvals as they either existed prior to 1971 or are considered to be livestock handling/collection facilities and do not meet the criteria requiring provincial approval. Therefore, these operations may not have undergone a regulatory review. Without a detailed investigation of the environmental impacts of these operations, there is no assurance that source waters are adequately protected in these locations. However, some of the livestock handling facilities within Moose Jaw are currently developing plans for surface runoff containment. Other smaller operations within the watershed may not require provincial intensive livestock operation approval. But where these operations are located within close proximity to surface water, it is important to exercise caution to ensure that they minimize any adverse impacts.

Recommendations

- The provincial government should discourage or limit the winter (frozen ground) spreading of intensive livestock operation manure by requiring adequate winter storage capacity and by having rural municipalities develop bylaws to ensure compliance.
- Educate producers about intensive livestock operation classification and approval requirements.

Key Action: Review the Agricultural Operations Regulations to consider limiting the winter spreading of manure.

Completion date	Responsibility
2006	**Saskatchewan Agriculture and Food**

Key Action: Municipalities should have zoning bylaws to administer intensive livestock operations.

Completion date	Responsibility
2007	**Saskatchewan Government Relations** All municipalities Saskatchewan Agriculture and Food

Key Action: Develop field tours, seminars and newsletter articles to educate producers about intensive livestock operation classification and approval requirements.

Completion date	Responsibility
2011	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Watershed Authority

Measure of Success: Three activities completed within five years.

6.2.3.4 Surface Water Drainage

Objectives

- Minimize negative impacts from drainage projects.

Wetlands play an important hydrological role in storing and releasing water, filtering contaminants, recharging local and regional groundwater supplies, reducing peak flows, protecting fish habitat, and preventing erosion. Wetlands store water and help reduce flooding during runoff, but become less effective in larger runoff events.

Drainage programs have been in place since the late 1920's. The majority of land that could be easily drained in the Moose Jaw River Watershed was drained in the late 1970's. In 1974, an extreme flood event provided one of the wettest years on record and flooded large portions of land. Because grain prices were high at this time, a significant amount of land was drained to allow more acres to be farmed. In 1981, an approval process for drainage works was put into place. Works constructed prior to 1981 do not require approval but are subject to regulations.

A grassed drainage ditch, constructed in the 1920's

Drainage has the potential to increase the velocity and decrease the duration of water flows. As velocities increase, water can carry more sediment. When they decrease, such as when a water flow enters an impoundment or reaches a level portion of a ditch or channel, it will deposit its sediment load. During high runoff events, wetlands will fill and spill downstream. The amount of water added from drained wetland areas during a high runoff event is small when compared to the total volume of flood waters. Therefore, during high runoff events drainage has little impact on water flows and flooding downstream, but can add to flows in the more frequent low to medium flood events. In low to medium flood events, intact wetlands may affect the timing, peaks and volume of runoff.

Recommendations

- Promote beneficial management practices, provide technical advice, and provide funding for existing drainage projects to minimize negative effects.
- All new drainage projects should have approvals before construction.
- The provincial government should provide increased funding and support for controlled and organized drainage in order to: decrease erosion in areas of unauthorized drainage; improve water quality; and educate landowners on beneficial management practices for maintaining ditches, control structures, and outlets of drainage projects. [Controlling and organizing existing drainage activities would not necessarily increase drainage, as the majority of land that could be easily drained has already been drained. Rather, it would minimize the impacts from existing (unorganized) drainage activities.]
- The federal and provincial governments should develop policies and funding programs to conserve and restore wetlands by having society compensate landowners for retaining or

enhancing natural water storage areas, and/or to reduce taxes on lands which are retained for their natural values.

- Promote consultation between upstream and downstream users to ensure that drainage activities are not causing significant problems.
- The Saskatchewan Watershed Authority should consult with the Saskatchewan Conservation and Development Association on any changes to drainage policies. The Saskatchewan Conservation and Development Association should relay this information to the Conservation and Development Area Authorities in the watershed.
- The Saskatchewan Watershed Authority should notify downstream municipalities of all new drainage projects being developed that will influence water flows through their municipality.

Key Action: Minimize impacts from unapproved drainage activities by providing support for these activities to change to a more controlled and organized drainage system (such as through conservation and development areas) and by funding the adoption of beneficial management practices.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority**

Key Action: Provide information on the benefits of proper and licensed drainage activities.

Completion date	Responsibility
2006 and ongoing	**Moose Jaw Creek Watershed Association #2** Local Conservation and Development Area Authorities

Key Action: Ensure all drainage works receive proper approvals before development, so as to prevent negative impacts downstream.

Completion date	Responsibility
2006 and ongoing	**Saskatchewan Watershed Authority**

Key Action: Develop policies and yearly payment programs to compensate landowners for conserving and restoring wetlands which provide ecological goods and services.

Completion date	Responsibility
2008	**Environment Canada** Ducks Unlimited Canada Saskatchewan Environment

6.2.4 Hazardous Material Storage and Disposal

Objectives

- Promote the safe storage, handling and disposal of chemical containers and dangerous goods and substances.
- Identify all orphaned sites.

Hazardous Material Storage Sites

Hazardous material storage sites include fuel depots, chemical warehouses/industries, hazardous substance storage tanks, chemical disposal sites, as well as pesticide and herbicide container drop-off locations. In 1989, Saskatchewan Environment developed a database to track regulated hazardous material storage facilities. Existing sites that meet the definition of stored hazardous materials or waste dangerous goods based on the quantity and type of chemicals stored are registered with Saskatchewan Environment and are required to meet regulations. Sites in existence prior to the development of the Hazardous Substances and Waste Dangerous Goods Regulations may not be identified in the database.

Orphaned Sites

Sites abandoned by their owners without proper cleanup or site decommissioning are a possible source of contamination. Currently, there are six known 'orphaned' sites in the Moose Jaw River Watershed. For more information, please see page 57 of the Background Report.

Disposal

There are a variety of chemicals used by industry and by rural and urban residents in the watershed. The improper disposal of chemicals and containers, such as depositing them in unapproved landfills, burning them, or littering, can lead to water, soil or air contamination.

Recommendations

- The provincial government should develop a recycling program to provide a rebate for pesticide containers to discourage burning of these containers.
- Develop a watershed-wide hazardous waste disposal system that collects 'household hazardous materials' and/or establishes hazardous waste disposal days in each Rural Municipality.
- The provincial government should provide an update on programming and funding for the decommissioning of contaminated orphaned sites.

Key Action: Provide an update on programming and funding for the decommissioning of contaminated orphaned sites.

Completion date	Responsibility
2007	Saskatchewan Environment

Key Action: Develop a pilot hazardous waste disposal project in two Rural Municipalities.

Completion date	Responsibility
2008	**Moose Jaw Creek Watershed Association #2** City of Moose Jaw

Key Action: Include a reminder/update in a newsletter on the existing pesticide container recycling program.

Completion date	Responsibility
2008	**Moose Jaw Creek Watershed Association #2** Crop Life Canada

6.2.5 Urban Impacts on Water Quality

Cities and towns concentrate wastes in the form of garbage and sewage, while roadways and storm water provide a direct source for contaminants to drain into the river. For planning purposes, urban impacts have been divided into three categories: municipal sewage lagoons and effluent releases; waste disposal grounds; and storm water runoff.

6.2.5.1 Municipal Sewage Lagoons and Effluent Releases

Objectives

- Protect ground and surface waters by minimizing the impacts of municipal sewage lagoons and ensure all municipal sewage is adequately treated.
- Discourage or eliminate effluent discharges to watercourses, where feasible.
- Encourage the prevention of surface and ground water contamination from private sewage systems.

There are 15 municipal sewage treatment facilities within the watershed. Of these, only Avonlea, Milestone, Rouleau, Caronport and Moose Jaw discharge their treated effluent into the Moose Jaw River or its tributaries. Wilcox discharges its effluent to an intermittent waterway that leads to the river; however, it is unlikely any of the treated effluent reaches the river in a typical year. For additional information, please see pages 49-53 of the Background Report.

Small Communities

Most small communities operate municipal sewage treatment facilities which utilize a biological treatment (facultative lagoon) system. A facultative lagoon is a type of treatment where different types of bacteria are present in both anaerobic and aerobic conditions. Guidelines for facultative lagoons are used as indicators of treatment effectiveness and are not strict standards. Hence, the effluent does not have to meet guidelines unless the operating permit specifically states this.

City of Moose Jaw

The City of Moose Jaw currently generates an average of 5,200 Ml (Million litres) of wastewater annually. The wastewater from the City of Moose Jaw and 15 Wing Air Force Base are pumped to the City lagoons for aeration treatment. The lagoons receive approximately 14.2 Ml/day. The lagoon system consists of nine lagoons ranging in size from 3.5 Ml to 1,574 Ml, with a total capacity of 4,416 Ml. Each cell has a varying rate of aeration. The final treated effluent is pumped to cells 7 and 8 for storage and irrigation use.

The effluent irrigation utilizes a fully automated pump system located at the lagoon storage cells. The treated effluent is pumped 6.5 km to the irrigation sites near the community of Baildon. It is used to irrigate forage crops to remove the nitrogen and phosphorous as a form of tertiary treatment. Only surface runoff and some subsurface water from the irrigation process enter the Moose Jaw River.

In years of high precipitation and low irrigation requirements, the storage capacity of the lagoons is reached and excess treated effluent must be removed to allow for winter storage. The City of Moose Jaw will obtain a temporary permit to treat and discharge the treated effluent directly into the Moose Jaw River. This special treatment and discharge is done during the early fall after an estimate of final effluent volumes has been calculated. The excess volume of effluent which must be released is treated with aluminium sulphate to remove phosphorus and is disinfected before being discharged to the river.

Private (domestic) Sewage Systems

Private (domestic) sewage systems should be properly located and maintained. Improper management or poor location planning with regards to the natural flow of water can cause problems for source water. For example, emptying septic tanks into a coulee or water run might lead to contamination of a water course. Also, the location of the well must be considered. For example, a well should not be located where runoff from septic discharge could reach it. For objectives and recommendations regarding well location and protection, see section 6.1.

Recommendations

- The provincial government should ensure all municipal lagoons have operating permits, and should submit an annual report on its ongoing review of municipal wastewater systems to the Moose Jaw Creek Watershed Association #2.
- Educate the public on private sewage and grey water treatment alternatives and water conservation methods to reduce sewage volumes.
- Expand effluent irrigation within the watershed to encourage the recycling of nutrients and the secondary use of treated wastewater as a valuable commodity. Municipalities should consider effluent irrigation when determining treatment options.
- The provincial government should encourage the construction of wetlands for wastewater storage and tertiary treatment prior to release.
- Ensure all sewage lagoon cells are properly sized and/or designed.
- Regulatory agencies should investigate ways to economically improve the quality of effluent water releases.
- The City of Moose Jaw should ensure a potable water source is available to residents within the influence of any future effluent irrigation prior to its expansion.

- The City of Moose Jaw should submit an annual report on its sewage treatment program (including the effluent irrigation and all discharges and associated water quality monitoring) to the Moose Jaw Creek Watershed Association #2.
- The provincial government should standardize effluent release regulations for small systems of less than 10,000 m^3/day (similar to Environment Canada's plan for cities) by 2008.
- The provincial government should ensure all effluent releases meet current standards and change procedures to only allow releases during times which would have the least impact on downstream users.
- Ensure private sewage discharges do not drain into water wells or off the owner's property.
- Sewage lagoon operators should notify downstream municipalities when effluent releases occur.
- The City of Moose Jaw should provide a copy of the pre-design report for enhanced wastewater treatment to the Moose Jaw Creek Watershed Association #2.

Key Action: Provide information through newsletters, brochures and websites on sewage and grey water treatment alternatives, as well as the proper sizing of sewage lagoons.

Completion date	Responsibility
2007	**Moose Jaw Creek Watershed Association #2** Saskatchewan Environment Saskatchewan Health

Key Action: Review effluent release data to ensure compliance and to develop beneficial management practices pertaining to the timing of releases.

Completion date	Responsibility
2007	**Saskatchewan Environment**

Key Action: Investigate new treatment methods.

Completion date	Responsibility
2008	**Environment Canada** Saskatchewan Environment

Conduct research on two communities in the watershed to investigate new ways to economically improve the quality of effluent water releases.

Key Action: Standardize effluent release regulations for small systems.

Completion date	Responsibility
2008	**Saskatchewan Environment**

6.2.5.2 Waste Disposal Grounds (landfills)

Photo courtesy of Saskatchewan Environment

Objectives

- Reduce solid wastes and ensure all waste disposal grounds are properly operated to minimize or eliminate sources of contamination to both ground and surface waters.

There are 24 known waste disposal grounds (landfills) within the watershed. Improperly located and/or controlled waste disposal grounds can be a source of contamination to ground and surface waters. Some facilities in the watershed do not have operating approvals from Saskatchewan Environment. For further information, please see page 53 of the Background Report.

The greatest concern with municipal landfills and private garbage disposal is the burning of refuse. Burning converts harmless waste into very toxic materials, and makes them easily available to be washed into ground and surface waters. For example, plastics in a landfill are not harmful to human health, but when burnt they are converted into toxic gases and other harmful compounds which are released into the air and water.

Recommendations

- Saskatchewan Environment should strengthen provincial littering regulations, fines and enforcement; and should increase public awareness about littering by using timely advertising (in March and April), placing no-littering signs specifying possible fines, and providing educational materials for school programs.
- Saskatchewan Environment should work with municipalities to ensure that new landfill regulations are environmentally and financially manageable.
- Develop a watershed-wide plastic recycling program which includes larger plastic containers that are not usually recycled (such as oil containers).
- Saskatchewan Environment should provide educational materials to the public on the benefits and proper methods of garbage disposal, as well as on the specific problems associated with landfills including the harmful effects of burning plastics.
- Saskatchewan Environment should encourage industry and manufacturers to use recyclable/biodegradable materials for packaging products.
- Promote conservation and recycling to reduce garbage, such as the sorting of plastics and tins for convenient recycling purposes.
- Encourage municipalities to have one or more free-waste-disposal weekends to discourage littering during spring and fall cleanups.
- Encourage producers to use Environmental Farm Plans to access funding to improve farm storage of products and the disposal of agricultural waste.
- Develop a voluntary watershed-wide clean-up program including the notification of all landowners adjacent to the river of the benefits of cleaning up old dump sites on the river.
- Monitor leachate from improperly sited waste disposal grounds.
- Encourage municipalities to report specific landfill concerns to Saskatchewan Environment's Environmental Protection Officers.

Key Action: Participate in the Great Canadian Shoreline Clean-Up program.

Completion date	Responsibility
Annually for 2 years	Moose Jaw Creek Watershed Association #2

Key Action: Submit a newsletter article to the Saskatchewan Association of Rural Municipalities to increase awareness of liabilities, guidelines and problems associated with improperly maintained/managed landfills, and to encourage municipalities to report problematic landfills for technical assistance.

Completion date	Responsibility
2006	**Saskatchewan Environment** Saskatchewan Association of Rural Municipalities

Key Action: Seek out landowner cooperation for a pilot clean-up project of an old dump site along the river.

Completion date	Responsibility
2007	**Moose Jaw Creek Watershed Association #2** Environment Canada Fisheries and Oceans Canada Saskatchewan Environment

Key Action: Develop a provincial household plastic recycling program which encourages rural and urban drop-off sites.

Completion date	Responsibility
2008	**Saskatchewan Environment** Rural and urban municipalities within the watershed

Key Action: Use the Moose Jaw River Watershed as a pilot for the household plastic recycling program.

Completion date	Responsibility
2007	**Saskatchewan Environment** Rural and urban municipalities within the watershed

Measure of Success: To have the pilot program started in 2007.

Key Action: Use billboards and newspapers to notify users of drop-off locations and purposes for recycling.

Completion date	Responsibility
2007	**Saskatchewan Environment** Rural and urban municipalities within the watershed

Key Action: Ensure adequate manpower and motivation to enforce current littering regulations.

Completion date	Responsibility
2008	**Saskatchewan Environment**

Measure of Success: Begin hiring additional staff by 2008.

Photo courtesy of the City of Moose Jaw

6.2.5.3 Urban Storm Water

Objectives

- See general water quality objectives.

Storm water from the City of Moose Jaw and other communities is a potential source of pollutants. It is not currently monitored but is suspected to contain salt, oil, nutrients, as well as any chemicals that could be accidentally or intentionally poured down storm water drains.

Recommendations

- Saskatchewan Environment should develop and implement a long-term storm water management plan for both new and existing urban areas.
- The City of Moose Jaw should collect data on its storm water runoff.
- Educate urban residents on the potential impacts of storm water runoff, such as through the Yellow Fish Road Program.

Key Action: Incorporate storm water runoff into a test pilot monitoring program.

Completion date	Responsibility
2006 and ongoing	**City of Moose Jaw** Moose Jaw Creek Watershed Association #2 Saskatchewan Environment

Key Action: Educate urban residents on the potential impacts of storm water runoff.

Completion date	Responsibility
Fall 2006/ongoing	**Moose Jaw Creek Watershed Association #2** City of Moose Jaw Schools SaskWater Trout Unlimited Canada

Measure of Success: One field day per year.

Key Action: Complete storm water management guidelines currently being developed.

Completion date	Responsibility
2007	**Saskatchewan Environment**

Photo courtesy of Saskatchewan Highways and Transportation

6.2.6 Road Salts

Objectives

- See general water quality objectives.

Road salt is considered "toxic" under the *Canadian Environmental Protection Act*, meaning that it is harmful to the environment in excessive amounts. In April 2005, Saskatchewan Highways and Transportation completed its Road Salt Management Plan in compliance with Environment Canada's code of practice for the environmental management of road salts. The code's objective is to ensure environmental protection while maintaining road safety.

The Road Salt Management Plan has three initiatives to help protect the environment. It requires: more stringent controls on salt storage and containment; increased snow and ice control training for staff; and extra protection for environmentally sensitive areas. Saskatchewan Highways and Transportation began work on implementing the new plan in 2005.

The City of Moose Jaw economizes its use of road salt and thereby reduces the impact on the environment. The city tries to manage its salt-sand mixture at less than five percent salt; however, in warmer winter weather this may increase to a 10 percent salt mixture.

Recommendations

- Monitor the use and disposal of road salt, and encourage the use of more environmentally-friendly alternatives for maintaining safe winter roads.

Key Actions

- None were required as the recommendation is already being implemented by Saskatchewan Highways and Transportation.

6.3 Surface Water Quantity

Hydrometric (flow/volume) data has been collected on the Moose Jaw River since the early 1900's, with water level data having been collected at ten locations for varying time periods. There is considerable variability in annual flow volumes ranging from 375,000 dam^3 (80 billion gallons) to zero. Approximately 20 percent of years have virtually no flow. With the exception of localized intense rainfall events, daily peak flows usually increase downstream. Daily average flows range from 370 m^3/s (81,400 gal/sec) to zero.

The Moose Jaw River, similar to other prairie streams, does not flow all year round. Some years there is no flow, and in other years flow only occurs for a short time during spring runoff. In only one of every ten years is there enough rainfall to produce significant flow in the summer. Usually, the peak flow takes an average of four days to get from Avonlea to Moose Jaw. During extremely wet years, this may take between two to three days. In 1974, the peak flows in Thunder (Sandy) Creek and Moose Jaw River reached Moose Jaw at approximately the same time and resulted in an extreme flood event.

Floods

There are concerns about flooding along the Moose Jaw River. Flooding and increased flows can increase erosion on unstable banks.

1948 spring runoff through Churchill Park in Moose Jaw

Photo courtesy of the Saskatchewan Archives Board

Based on slope, the Moose Jaw River can be divided into two regions. The upper portion from Yellow Grass to Rouleau is very flat and prone to flooding; while the lower portion from Moose Jaw to Nicole Marsh is steeper with faster water velocities.

Erosion from both natural stream banks and from man-made disturbances on the landscape has resulted in silt build-up in the river. The high runoff events occurring in the late 1990's have resulted in flooding, erosion and siltation.

Pelican Lake

Pelican Lake is a 2,400 hectare lake that was formed naturally from glacial processes. The hydrology of this area is highly variable. Typically, Pelican Lake is subject to a severe water deficit and is frequently dry, with the exception of years with high runoff. Historically, water levels were high in the 1950's, the mid 1970's, and again in the 1990's.

In 1993, Ducks Unlimited Canada imported water through Thunder Creek and raised the water levels of Pelican Lake from dry (elevation 561.1 m) to a depth of 0.7 m. This was the last significant non-natural import into the system. In 1994, a one in twenty year flood event occurred that resulted in lake levels reaching a depth of 2.1 m and an elevation of 563.2 m. This was followed by high runoff events in 1996, 1997, 1999 and 2003.

There is a natural high ground with an elevation of 563.9 m which separates several gravel pits at the south end from the rest of the lake. In 1996, the gravel pits were flooded when the water levels exceeded this elevation and reached a height of 564.4 m. In 1997, the water level of Pelican Lake reached 565.4 m, the full supply level.

The gravel pits are used by the Rural Municipalities of Marquis, Moose Jaw and Eyebrow, as well as Saskatchewan Highways and Transportation. Flooding also affected several roads in the Rural Municipality of Marquis. Since the peak in 1997, water levels have begun to drop.

The Advisory Committee wants to see the water levels on Pelican Lake lowered. The Technical Committee provided a report on several options for a lake stabilization project. This type of project is not directly related to source water protection and is outside the parameters of the present planning process. Therefore, members were asked to contact the Saskatchewan Watershed Authority's Weyburn office at 306-848-2345 to pursue this item further.

Ice Jams

Ice jams are unpredictable. When they occur, they can cause significant damage to downstream infrastructure. Objectives and recommendations were formulated to address this concern. However, since they are not directly related to source water protection, they are not included here.

Droughts

The Moose Jaw River Watershed is susceptible to drought conditions as water loss (evaporation) exceeds precipitation in most years. Prolonged drought will cause significant stress on surface water supplies. Wetlands help to mitigate drought conditions by increasing surface water storage and by recharging groundwater supplies. Although the watershed is not currently in a drought, individuals should always be prepared and self-reliant concerning drought conditions.

6.3.1 Avonlea Reservoir Water Supply to Downstream Users

Objectives

- Ensure water allocations from Avonlea Reservoir are well understood by all users of the reservoir.

Water flowing over the earth spillway, Avonlea Reservoir, June 1999

During drought periods such as in the late eighties, many surface water supplies were at critically low levels. There is some concern that drought conditions could impact water supplies for the Village of Avonlea as well as for irrigators and livestock operations dependent on Avonlea Reservoir.

Avonlea Reservoir's assured water supply is fully allocated, and therefore is not available for any further development. During the 1980's, water levels in the reservoir dropped significantly, creating concern that there would not be sufficient water for the village. The village's water treatment plant provides potable water for the Long Creek Golf Course, the Redthorpe pipeline and several acreages out of its allocation. The village pumps water from the reservoir into a storage dugout. In the summer, the water quality in the dugout is relatively good; however, it deteriorates during winter.

In 2005, the Saskatchewan Watershed Authority refurbished the Avonlea Dam to address dam safety concerns by building a new service spillway and strengthening the embankment. This did not include raising the full supply level of the reservoir.

Analysis

The Technical Committee produced a report answering the questions raised during discussion on Avonlea Reservoir. These included: How much water does the Avonlea Reservoir hold? Who are the users and what are their allocations? What do they use the water for? How are reservoir releases managed? During a prolonged drought, when reservoir levels are low, who has the rights to the water? Are there any water agreements with the Village of Avonlea? A copy of the report can be found in Appendix E on the CD attached to this document.

Recommendations

- Provide alternative water source and storage supply information to water users downstream of the Avonlea Dam.
- The Saskatchewan Watershed Authority should continue working with the Avonlea Water Users, the Rural Municipality of Elmsthorpe No. 100 and the Village of Avonlea to ensure their water concerns are understood and their needs are met.
- Monitor any potential water quantity supply problems for livestock operations below the dam.

Key Action: Provide information on the operation of Avonlea Reservoir to downstream users.

Completion date	Responsibility
2006	**Saskatchewan Watershed Authority**

Key Action: Provide information on livestock water supply alternatives to downstream users through newsletter articles, demonstration projects and field days.

Completion date	Responsibility
2006 and ongoing	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority

6.3.2 Wastage and Inefficient Use of Water

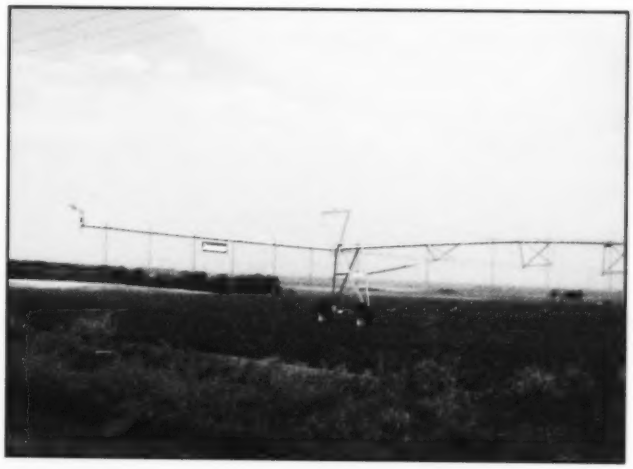
Objectives

- Use water more efficiently to grow the economy and the population.
- Retain water from the Moose Jaw River in the watershed.

An important component of drought management is water conservation and the more efficient use of the current water resource.

Recommendations

- Conduct irrigation demonstration projects to promote the utilization of existing systems to full capacity and to improve water efficiencies.
- Saskatchewan Agriculture and Food should continue research into improving water efficiencies.
- Schools should use the Provincial Water Conservation Strategy to provide course materials on conservation and efficient use of water.



- Ducks Unlimited Canada should hold back additional spring runoff in the Heritage Marsh Lakes on Thunder Creek until after the thaw period. Ducks Unlimited Canada should continue ongoing communication with the Thunder Creek Irrigators.

Key Action: Promote attendance at the Irrigation Field Day.

Completion date	Responsibility
2006	Canada-Saskatchewan Irrigation Diversification Centre

Key Action: Have the Canada-Saskatchewan Irrigation Diversification Centre provide information on irrigation water conservation.

Completion date	Responsibility
2006	Canada-Saskatchewan Irrigation Diversification Centre Moose Jaw Creek Watershed Association #2

Key Action: Feature newsletter articles on projects which demonstrate water conservation.

Completion date	Responsibility
2007	Moose Jaw Creek Watershed Association #2

6.3.3 Water Use and Storage Capacity

Objectives

- Examine all possibilities to expand efficient water usage and supplies in the watershed.

Analysis

The Technical Committee produced a report on the feasibility, costs and pros and cons of developing water storage structures. Please see Appendix E on the CD attached to this document for a copy of this report.

Recommendations

- The Prairie Farm Rehabilitation Administration should enhance funding for pipelines and dugouts where needed, and ensure the application process is user-friendly.
- The provincial government should work with the Saskatchewan Irrigation Projects Association to develop programs/projects to expand irrigation in areas where it is suitable and economically viable.

Baildon weir on the Moose Jaw River

- Saskatchewan Agriculture and Food and the Irrigation Crop Diversification Corporation should provide Rural Municipalities with irrigation development contact information and procedures.
- Develop a water supply needs/enhancement plan to explore the feasibly of increasing water storage and to:
    - help reduce the impacts of drought on the watershed;
    - identify future and existing water supply needs in the watershed; and
    - identify purposes for water storage, possible locations and available options (e.g. reservoirs, regional pipelines, dugouts and/or dredging).
- Determine the in-stream flow needs for the Moose Jaw River Watershed to establish the water requirements to sustain the natural aquatic ecosystem.
- Determine methods to improve the river's flow in order to enhance water quality, fish habitat, and wintering sites for fish.
- Ensure dugouts are properly designed, located, and maintained, and that they include a surrounding grassed buffer area.

Key Action: Investigate the opportunities for expanding irrigation in the watershed.

Completion date	Responsibility
2006	**Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority

Key Action: Enhance the network of hydrometric stations to better quantify the hydrology of the watershed and to provide better information for future water management decisions.

Completion date	Responsibility
2007	**Saskatchewan Watershed Authority**

Key Action: Determine the in-stream flow needs for the Moose Jaw River Watershed.

Completion date	Responsibility
2007	**Saskatchewan Watershed Authority** Fisheries and Oceans Canada

Key Action: Deliver a workshop showing options to maximize water quality in dugouts.

Completion date	Responsibility
2009	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority

Measure of Success: One workshop in each of the two planning areas over three years.

Key Action: Determine the water supply needs of the watershed and identify/develop the tools necessary to meet current and long-term economic development needs.

Completion date	Responsibility
2010	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration

6.4 Ecosystem Health

6.4.1 Noxious Weeds in Riparian Areas

Objectives

- Formulate a management plan (and guidelines) to address noxious weeds along waterways where spraying cannot occur.

Photo courtesy of the Wakamow Valley Authority

Noxious weeds pose a threat by reducing the biodiversity of plants and animals in the watershed. In riparian areas, the presence of noxious weeds can destabilize these natural buffer zones, resulting in increased erosion and decreased filtration of contaminants. Control of noxious weeds can be difficult, especially around waterbodies. Furthermore, the *Environmental Management and Protection Act* restricts the use of chemical weed sprays within 25 metres, or 50 metres for aerial applications, of a water body including intermittent waterways and drainage ditches, unless a permit is obtained. This poses a problem, as noxious weeds will readily grow in riparian areas and can be easily spread by flowing water.

Analysis

The Technical Committee produced a report answering the questions raised during discussions on noxious weed legislation and control. Please see Appendix E, included on the CD attached to this document for a copy of this report.

Recommendations

- Create and locate informational signs to prevent and reduce the spread of noxious weeds along trails and roadway crossings.
- Designate specific trails or foot paths to restrict traffic in sensitive areas.

- Ensure municipalities do not ignore the threat of noxious weeds by:
  - o requesting that Saskatchewan Agriculture and Food provide presentations on the need for noxious weed control; or
  - o encouraging the ratepayers in delinquent municipalities to petition for the hiring of a weed inspector.
- The Moose Jaw Creek Watershed Association #2 and Saskatchewan Agriculture and Food should educate the public on how to identify and control noxious weeds (e.g. leafy spurge, scentless chamomile, purple loosestrife) using biological/non-chemical methods.
- Offer support to the Saskatchewan Forage Council to pursue tighter standards (zero tolerance) on the concentration of noxious weeds in certified grass and flower seeds.
- Provide information to florists on the problems of including noxious weeds in flower arrangements.

Key Action: Remind all municipalities of their responsibilities concerning noxious weeds.

Completion date	Responsibility
2006	Saskatchewan Agriculture and Food

Key Action: Provide informational brochures or letters notifying florists of the problems with noxious weeds in flower arrangements.

Completion date	Responsibility
2006	Native Plant Society of Saskatchewan

Key Action: Work cooperatively with Rural Municipalities to control noxious weeds by sharing information.

Completion date	Responsibility
2006	Moose Jaw Creek Watershed Association #2

Key Action: Write a letter supporting the Saskatchewan Forage Council's pursuit of tighter standards for certified grass and flower seeds.

Completion date	Responsibility
2006	Moose Jaw Creek Watershed Association #2

Key Action: Write a letter supporting the Native Plant Society of Saskatchewan's pursuit of notifying the public on noxious weeds in seed mixtures.

Completion date	Responsibility
2006	Moose Jaw Creek Watershed Association #2

Key Action: Develop a noxious weed control sign for use by municipalities and recreational groups.

Completion date	Responsibility
2007	**Saskatchewan Agriculture and Food** **Saskatchewan Association of Rural Municipalities** Saskatchewan Trails Association

Key Action: Strategically place noxious weed control signs along roadways, trails, and in problematic areas.

Completion date	Responsibility
2008	**Rural Municipalities** **Trans Canada Trail** Saskatchewan Association of Rural Municipalities Saskatchewan Highways and Transportation Wakamow Valley Authority

6.4.2 Fish Habitat Degradation

Objectives

- Maintain and improve fish habitat in the Moose Jaw River.
- Reduce blockages to fish migration in the Moose Jaw River in ways that would not reduce water supply.

Aside from the 1984 provincial fisheries study to examine the fisheries potential of the Moose Jaw River within the City of Moose Jaw, no comprehensive assessment of fish habitat has been done in the remainder of the river. Generally, fish habitat in the Moose Jaw River is fragmented throughout most of its length by numerous dams and weirs which cause blockages to fish migrations. As with many prairie rivers, the Moose Jaw River has the potential to provide important spring spawning and rearing habitat for fish, especially during years of higher flows. These years of good fish production can be very important to downstream fish populations in the Qu'Appelle River. Additional information on fish habitat and hydrology within the Moose Jaw River can be found on pages 12-13 and 27-30 of the Background Report.

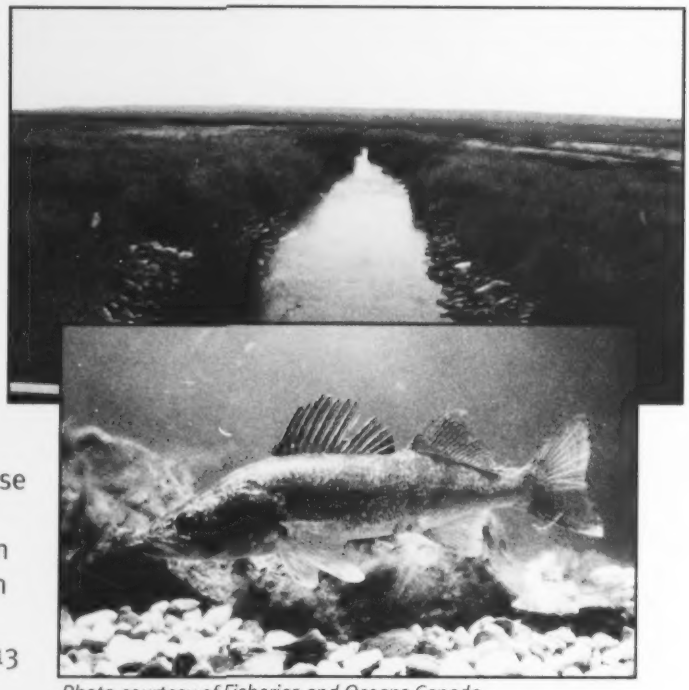


Photo courtesy of Fisheries and Oceans Canada

Analysis

The Technical Committee produced a report answering the questions raised during discussion on fish habitat. Please see Appendix E on the CD attached to this document for a copy of the report.

Recommendation

- Enhance fish habitat by promoting riparian health and demonstration projects using the Moose Jaw Creek Watershed Association's extension programs and Fisheries and Oceans Canada's Stewardship in Action Initiative funding.
- Inventory fish movements (migratory patterns) to determine options for modifying fish migration blockages and to locate where fish ladders/ways could be installed.
- Identify areas of fish habitat degradation and opportunities for fish habitat improvement.

Key Action: Inventory fish movements and identify opportunities for fish habitat improvement.

Completion date	Responsibility
2007	**Saskatchewan Environment** **Fisheries and Oceans Canada**

7. Summary of Key Actions

The key actions form a key component to the implementation strategy within the watershed plan and are based on the recommendations decided upon by the Watershed Advisory Committee. Each key action is listed under the appropriate recommendation in section 6. Here, the key actions are grouped into similar categories and sorted by completion date.

Education

Key Action	Completion Date	Responsibility
Deliver a well decommissioning field day each year.	**2005 and ongoing**	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority
Measure of Success: Completion of one field day per year for three years.		
Provide public education on agricultural impacts on water quality by using existing publications and writing news articles.	**Ongoing**	**Moose Jaw Creek Watershed Association #2** **Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration
Measure of Success: One article produced per year.		
Promote Environmental Farm Plan workshops.	**Ongoing**	**Provincial Council of Agriculture Development and Diversification Boards Inc.** Moose Jaw Creek Watershed Association #2
Provide education on relocating or modifying wintering sites in riparian areas.	**Ongoing**	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2 Saskatchewan Agriculture and Food
Measure of Success: One demonstration project/tour per year, dependant upon riparian assessments.		
Educate and demonstrate the benefits of protecting riparian and other sensitive areas.	**2006 and ongoing**	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Watershed Authority
Measure of Success: One demonstration project/tour and one workshop per year until 2008.		
Provide information on the benefits of proper and licensed drainage activities.	**2006 and ongoing**	**Moose Jaw Creek Watershed Association #2** Local Conservation and Development Area Authorities

Key Action	Completion Date	Responsibility
Educate urban residents on the potential impacts of storm water runoff.	**Fall 2006/ongoing**	**Moose Jaw Creek Watershed Association #2** City of Moose Jaw Schools SaskWater Trout Unlimited Canada
	Measure of Success: One field day per year.	
Provide information on livestock water supply alternatives to downstream users, through newsletter articles, demonstration projects and field days.	**2006 and ongoing**	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority
Create a document addressing all issues surrounding groundwater protection.	**2006**	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Environment Saskatchewan Ground Water Association
Provide information on stewardship, water quality, and agency responsibilities.	**2006**	**Saskatchewan Network of Watershed Stewards** Fisheries and Oceans Canada Moose Jaw Creek Watershed Association #2 Saskatchewan Environment
This information should be posted online and be provided to the Moose Jaw Creek Watershed Association #2.		
Submit a newsletter article to Saskatchewan Association of Rural Municipalities to increase awareness of liabilities, guidelines and problems associated with improperly maintained/managed landfills and to encourage municipalities to report problematic landfills for technical assistance.	**2006**	**Saskatchewan Environment** Saskatchewan Association of Rural Municipalities
Provide information on the operation of Avonlea Reservoir to downstream users.	**2006**	**Saskatchewan Watershed Authority**
Promote attendance at the Irrigation Field Day.	**2006**	**Canada-Saskatchewan Irrigation Diversification Centre**

Key Action	Completion Date	Responsibility
Have the Canada-Saskatchewan Irrigation Diversification Centre provide information on irrigation water conservation.	2006	**Canada-Saskatchewan Irrigation Diversification Centre** Moose Jaw Creek Watershed Association #2
Remind all municipalities of their responsibilities concerning noxious weeds.	2006	**Saskatchewan Agriculture and Food**
Provide informational brochures or letters notifying florists of the problems with noxious weeds in flower arrangements.	2006	**Native Plant Society of Saskatchewan**
Work cooperatively with Rural Municipalities to control noxious weeds by sharing information.	2006	**Moose Jaw Creek Watershed Association #2**
Provide an update on programming and funding for the decommissioning of contaminated orphaned sites.	2007	**Saskatchewan Environment**
Provide information through newsletters, brochures and websites on sewage and grey water treatment alternatives, as well as the proper sizing of sewage lagoons.	2007	**Moose Jaw Creek Watershed Association #2** Saskatchewan Environment Saskatchewan Health
Feature newsletter articles on projects which demonstrate water conservation.	2007	**Moose Jaw Creek Watershed Association #2**
Include a reminder/update in a newsletter on the existing pesticide container recycling program.	2008	**Moose Jaw Creek Watershed Association #2** Crop Life Canada
Develop field tours, seminars and newsletter articles to educate producers about intensive livestock operation classification and approval requirements.	2011	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Watershed Authority

Measure of Success: Three activities completed within five years.

Legislation, Policy or Program Changes

Key Action	Completion Date	Responsibility
Ensure all drainage works receive proper approvals before development, so as to prevent negative impacts downstream.	2006 and ongoing	**Saskatchewan Watershed Authority**
Enhance support for groundwater mapping activities.	2006	**Saskatchewan Watershed Authority**
Create an enhanced funding program for groundwater protection.	2006	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration
Provide funding for a watershed coordinator to promote beneficial management practices.	2006	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2
Review the Agricultural Operations Regulations to consider limiting the winter spreading of manure.	2006	**Saskatchewan Agriculture and Food**
Minimize impacts from unapproved drainage activities by providing support for these activities to change to a more controlled and organized drainage system (such as through conservation and development areas) and by funding the adoption of beneficial management practices.	2006	**Saskatchewan Watershed Authority**
Municipalities should have zoning bylaws to administer intensive livestock operations.	2007	**Saskatchewan Government Relations** All municipalities Saskatchewan Agriculture and Food
Review effluent release data to ensure compliance and to develop beneficial management practices pertaining to the timing of releases.	2007	**Saskatchewan Environment**
Complete storm water management guidelines currently being developed.	2007	**Saskatchewan Environment**

Key Action	Completion Date	Responsibility
Enhance the network of hydrometric stations to better quantify the hydrology of the watershed and to provide better information for future water management decisions.	2007	**Saskatchewan Watershed Authority**
For new programs, increase funding payments for land conversion to permanent cover and coordinate program delivery among multiple agencies.	2008	**Prairie Farm Rehabilitation Administration** Ducks Unlimited Canada Nature Saskatchewan Saskatchewan Environment Saskatchewan Watershed Authority Saskatchewan Wildlife Federation
Explore a yearly payment program for ecological goods and services covered by conserved lands.	2008	**Prairie Farm Rehabilitation Administration**
Develop policies and yearly payment programs to compensate landowners for conserving and restoring wetlands which provide ecological goods and services.	2008	**Environment Canada** Ducks Unlimited Canada Saskatchewan Environment
Standardize effluent release regulations for small systems.	2008	**Saskatchewan Environment**
Develop a provincial household plastic recycling program which encourages rural and urban drop-off sites.	2008	**Saskatchewan Environment** Rural and urban municipalities within the watershed
Use the Moose Jaw River Watershed as a pilot for the household plastic recycling program.	2007	**Saskatchewan Environment** Rural and urban municipalities within the watershed
Use billboards and newspapers to notify users of drop-off locations and purposes for recycling.	2007	**Saskatchewan Environment** Rural and urban municipalities within the watershed
Ensure adequate manpower and motivation to enforce current littering regulations.	2008	**Saskatchewan Environment**

Specific Actions

Key Action	Completion Date	Responsibility
Identify agricultural impacts to water quality and mitigate with beneficial management practices.	**Ongoing**	**Moose Jaw Creek Watershed Association #2** **Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration Saskatchewan Environment Saskatchewan Watershed Authority
Participate in the Great Canadian Shoreline Clean-Up program.	**Annually for 2 years**	**Moose Jaw Creek Watershed Association #2**
Incorporate storm water runoff into a test pilot monitoring program.	**2006 and ongoing**	**City of Moose Jaw** Moose Jaw Creek Watershed Association #2 Saskatchewan Environment
Develop a long-term groundwater monitoring plan to track fluctuations in water quality and quantity.	**2006**	**Saskatchewan Watershed Authority** Prairie Farm Rehabilitation Administration Saskatchewan Environment Saskatchewan Health
Develop a water quality monitoring plan and provide funding.	**2006**	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration Saskatchewan Environment

Moose Jaw Creek Watershed Association #2 will write a letter requesting that Moose Jaw Asphalt, the Canadian Pacific Railway and other businesses share their data, and invite them to partner in monitoring efforts once funding has been secured from other sources.

Organize and conduct an emergency preparedness exercise.	**2006**	**Emergency Measures Organization** All municipalities in the watershed Canadian National Railway Canadian Pacific Railway
Investigate the opportunities for expanding irrigation in the watershed.	**2006**	**Saskatchewan Agriculture and Food** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority
Write a letter supporting the Saskatchewan Forage Council's pursuit of tighter standards for certified grass and flower seeds.	**2006**	**Moose Jaw Creek Watershed Association #2**
Write a letter supporting the Native Plant Society of Saskatchewan's pursuit of notifying the public on noxious weeds in seed mixtures.	**2006**	**Moose Jaw Creek Watershed Association #2**
Complete the analysis for the *Draft* Municipal Well Assessment Report.	**2007**	**Saskatchewan Watershed Authority**

Key Action	Completion Date	Responsibility
Seek out landowner cooperation for a pilot clean-up project of an old dump site along the river.	**2007**	**Moose Jaw Creek Watershed Association #2** Environment Canada Fisheries and Oceans Canada Saskatchewan Environment
Determine the in-stream flow needs for the Moose Jaw River Watershed.	**2007**	**Saskatchewan Watershed Authority** Fisheries and Oceans Canada
Develop a noxious weed control sign for use by municipalities and recreational groups.	**2007**	**Saskatchewan Agriculture and Food** **Saskatchewan Association of Rural Municipalities** Saskatchewan Trails Association
Inventory fish movements and identify opportunities for fish habitat improvement.	**2007**	**Fisheries and Oceans Canada** **Saskatchewan Environment**
Deliver the Agri-Environmental Group Plan.	**2008**	**Moose Jaw Creek Watershed Association #2**
Measure of Success: 150 projects completed by 2008.		
Conduct an assessment of riparian areas to address vulnerable and high risk areas.	**2008**	**Moose Jaw Creek Watershed Association #2** Fisheries and Oceans Canada Saskatchewan Watershed Authority
Develop a pilot hazardous waste disposal project in two rural municipalities.	**2008**	**Moose Jaw Creek Watershed Association #2** City of Moose Jaw
Investigate new treatment methods.	**2008**	**Environment Canada** Saskatchewan Environment
Conduct research on two communities in the watershed to investigate new ways to economically improve the quality of effluent water releases.		
Strategically place noxious weed control signs along roadways, trails, and in problematic areas.	**2008**	**Rural Municipalities** **Trans Canada Trail** Saskatchewan Association of Rural Municipalities Saskatchewan Highways and Transportation Wakamow Valley Authority
Deliver a workshop showing options to maximize water quality in dugouts.	**2009**	**Moose Jaw Creek Watershed Association #2** Prairie Farm Rehabilitation Administration Saskatchewan Watershed Authority
Measure of Success: One workshop in each of the two planning areas over three years.		

Key Action	Completion	Responsibility
Properly decommission unused Canadian National Railway/ Canadian Pacific Railway wells.	**2010**	**Canadian National Railway** **Canadian Pacific Railway**
Conduct a research study to determine agricultural impacts on nutrient loading and water quality.	**2010**	**Saskatchewan Watershed Authority** Joint Moose Jaw River Watershed Advisory Committee Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration Saskatchewan Agriculture and Food Saskatchewan Environment

Joint Moose Jaw River Watershed Advisory Committee and the Moose Jaw Creek Watershed Association #2 will write letters to request participation in Saskatchewan Watershed Authority's proposal to assess agricultural impacts on water quality.

Determine the water supply needs of the watershed and identify/develop the tools necessary to meet current and long-term economic development needs.	**2010**	**Saskatchewan Watershed Authority** Moose Jaw Creek Watershed Association #2 Prairie Farm Rehabilitation Administration

8. Appendices

A. Participants in the Planning Process

B. Moose Jaw River Watershed Source Water Protection Plan (on CD or at www.swa.ca)

C. Watershed Advisory Committee Terms of Reference (on CD)

D. Background Report (on CD)

E. Analysis (on CD)

F. Municipal Surface Water Report (on CD)

G. Draft Municipal Well Assessment Report (on CD)

H. Newsletters (on CD)

I. Glossary (on CD)

A. Participants in the Planning Process

Participants on the Moose Jaw River Watershed Advisory Committee (including the Moose Jaw River Watershed Stewardship Association)

Member	Organization
Don Allewell	R.M. of Norton No. 69
*Terry Anthony	R.M. of Baildon No. 131
*Jim Armstrong	R.M. of Redburn No. 130
Robert Badley	Town of Rouleau
Don Fox	Baildon Water Users Association
*Keith Gadd	Old Guard CAA #38
Rick Gailbraith	Town of Milestone
Ken Hawkes	City of Moose Jaw (MACE)
*Wade Hicke	R.M. of Terrell No. 101
Barry Johnson	Lynbrook Golf Club
*Ryan Johnson	City of Moose Jaw
*Cal Jorstad	R.M. of Moose Jaw No. 161
Richard Linton	R.M. of Caledonia No. 99
*Greg Metz	R.M. of Bratt's Lake No. 129
*Ron Michell	Deer Ridge Golf and Country Club
*Terry Moon	R.M. of Scott No. 98
*Roy Morrison	R.M. of Pense No. 160
*Karyn Mossing	Trans Canada Trail
Wally Nelson	Long Creek Golf and Country Club
Darol Owens	R.M. of Moose Jaw No. 161
Fran Petruic	Dunnet Regional Park
*Darcy Phillips	R.M. of Caledonia No. 99
*Brad Pingert	R.M. of Norton No. 69
*Susanne Richard	Moose Jaw Wild Animal Park Conservation Society Inc.
*Milt Rigetti	Madrid CAA #142
*Brian Stirton	Old Guard CAA #38
Merlin Thompson	M & T Feedlot
*Doug Thul	R.M. of Redburn No. 130
Don Watson	R.M. of Brokenshell No. 68
*Bob Wills	Wakamow Valley Authority
Dale Wilson	Canadian Pacific Railway

*indicates current members of the Moose Jaw River Watershed Advisory Committee

Participants on the Thunder Creek Watershed Advisory Committee

Member	Organization
*Sandra Bathgate	Thunder Creek Irrigation District
*John Beck	R.M. of Eyebrow No. 193
Neil Crosbie	R.M. of Caron No. 162
*Robert Drake	R.M. of Eyebrow No. 193
Mike Gorgichuk	R.M. of Caron No. 162
*Chuck Guillaume	R.M. of Marquis No. 191
*Danny Hicks	R.M. of Rodgers No. 133
*Lorne Jackson	Riverhurst Irrigation District
*Charles Johnson	R.M. of Wheatlands No. 163
*Dale Johnson	Village of Mortlach
*Cal Jorstad	R.M. of Moose Jaw No. 161
*Jarrod Klassen	Thunder Creek Irrigation District
*Ellis Leaman	R.M. of Chaplin No. 164
Dave Marzolf	R.M. of Enfield No. 194
*Wayne Phillips	Village of Caronport
Joe Searle	R.M. of Wheatlands No. 163
Kim Searle	R.M. of Wheatlands No. 163
*Gary Stirling	R.M. of Wheatlands No. 163
*Garth Swanson	R.M. of Marquis No. 191
*Pete Thiessen	Village of Caronport
*Dale Young	R.M. of Wheatlands No. 163

*indicates current members of the Thunder Creek Watershed Advisory Committee

Participants on the Technical Committee

Member	Organization
*Twyla Armstrong	Moose Jaw Creek Watershed Association #2
Jim Babcock	Saskatchewan Agriculture, Food and Rural Revitalization
*Carol Churchward	Fisheries and Oceans Canada
*Wendi Dehod	Saskatchewan Agriculture and Food
*Martin Grajczyk	Saskatchewan Watershed Authority
*Ross Herrington	Canadian Wildlife Service
*Jeff Holland	Saskatchewan Highways and Transportation
Greg Holovach	Saskatchewan Environment
*Mai-Lihn Huynh	Prairie Farm Rehabilitation Administration
Ron Jenson	Saskatchewan Environment
*Ron Kerr	Government Relations
Carl Lazurko	Prairie Farm Rehabilitation Administration
*Ross Macdonald	Saskatchewan Watershed Authority
Serena McIver	Prairie Farm Rehabilitation Administration
*Clinton Molde	Saskatchewan Watershed Authority
Jody Oliver	Saskatchewan Watershed Authority
*Kevin O'Neill	Saskatchewan Watershed Authority
*Nolan Shaheen	Saskatchewan Watershed Authority
*Brad Uhrich	Ducks Unlimited Canada
*Richard Zitta	Saskatchewan Environment

*indicates current members of the Moose Jaw River Watershed Technical Committee

Planning Team

Member	Organization
John Durbin	Saskatchewan Watershed Authority
Jennifer Nelson	Saskatchewan Watershed Authority